

14.0 HUMAN & ECOLOGICAL HEALTH CONCERNS

The analysis in this section is summarized from the screening level analysis contained in Appendix J, Human Health, and Ecological Risk Assessment. It addresses the impacts from the proposed use of hazardous materials and potential generation of hazardous wastes under the Proposed Project and treatment alternatives where the use of commercial rotenone liquid formulations, powdered rotenone, and rotenone neutralization options with potassium permanganate are considered. In this context, hazardous materials and wastes are considered those substances with properties of toxicity, ignitability, corrosivity, and/or reactivity.

14.1 Environmental Setting/Affected Environment

Project activities are limited to the Lake Davis project area and include areas where equipment and rotenone formulations would be transported for staging, as well as throughout the reservoir and fringes of the reservoir where project activities would take place. For this reason, the study area for the risk assessment covers the entire reservoir, the tributaries and springs to the reservoir to the uppermost extent of treatment, and segments of receiving waters immediately downgradient of the reservoir, as well as land immediately downwind of the chemical application areas. Air, surface water, groundwater, sediments and biota potentially containing rotenone or formulation constituents are considered as potential exposure media in the affected environment.

The following sections provide a general overview of the toxicology and use of rotenone as a “piscicide,” defined as a pesticide with the intended function of killing undesirable fish species. The text below also summarizes the regulatory setting with respect to the use of rotenone formulations for fish eradication purposes, and how these regulations are applicable to the environmental setting where the use of rotenone for northern pike eradication is under consideration.

14.1.1 Toxicology and the Use of Pesticides

14.1.1.1 Pesticide Registration and Labeling Process

Under the Proposed Project, rotenone formulations would be used according to regulatory requirements for the transportation, treatment, and control activities involving the use of rotenone formulations for eradicating undesirable fish species. Federal and state regulations impose requirements on the registration and use of pesticides. The regulatory framework pertaining to the use of pesticides, the management of hazardous materials, and health and safety of pesticide applicators and project personnel is discussed below.

Federal Regulations

Definitions and Registration Procedures for Pesticides and other Chemicals

The U.S. Environmental Protection Agency (EPA) regulates pesticides under two major statutes: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA). Pesticides are defined under FIFRA as, “any substance intended for preventing, destroying, repelling, or mitigating any pest.” FIFRA

requires that pesticides be registered (licensed) by the USEPA before they may be sold or distributed for use in the United States, and that they perform their intended functions without causing unreasonable adverse effects on people and the environment when used according to USEPA-approved label directions.

USEPA requires extensive scientific research and supporting test data as part of its pesticide review and approval process before granting a registration for most pesticides. These studies allow the USEPA to assess risks to human health, domestic animals, wildlife, plants, groundwater, and beneficial insects, and to assess the potential for other environmental effects. When new evidence raises questions about the safety of a registered pesticide, the USEPA may take action to suspend or cancel its registration and revoke the associated residue tolerance. The USEPA may also undertake extensive special review of a pesticide's risks and benefits or work with manufacturers and users to implement changes in a pesticide's use (e.g., reducing application rates, or cancellation of a pesticide's use).

Special uses of pesticides, outside their original label specifications, can be considered on a case-by-case basis through FIFRA Section 24C (EPA 1996). However, the use of rotenone as a piscicide is already authorized in the State of California under FIFRA, and a 24C application to the USEPA is not required. The FFDCA authorizes the USEPA to set tolerances, or maximum legal limits, for pesticide residues in food. Thus, the FFDCA does not expressly regulate pesticide use, but residue limits established by this agency may result in a change in the use pattern regulated under FIFRA. Rotenone residues in food have not been established.

Rotenone was first registered for aquatic use in 1947, and the USEPA challenged the reregistration in 1976 (after the enactment of the Clean Water Act) when it became aware of a study that had alleged that rotenone might be a carcinogen. The conclusions of that study were further evaluated and subsequently disproven by the EPA (USEPA 1981), and the EPA concluded that the use of rotenone for fish control did not present a risk of unreasonable adverse effects to humans and non-aquatic wildlife. Notwithstanding, the action initiated a joint federal-state cooperative effort to fully evaluate all environmental aspects of rotenone toxicity and environmental fate through a reregistration process. Under the reregistration program the USEPA is systematically reviewing all pesticides registered before November 1984 to ensure that they meet current testing and safety standards. To this end, the USEPA recently released their ecological risk assessment on the reregistration of rotenone (USEPA 2006). This assessment summarized that aquatic risks to non-target aquatic organisms are significant, while risks to terrestrial wildlife and plants were determined to be insignificant when rotenone was applied as a piscicide. These conclusions were independently examined and confirmed in Appendix J, through food web modeling of potential risks from rotenone use in Lake Davis.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA; PL 94-469) requires regulation of commercial chemicals, *other than* [emphasis added] pesticide products, that present a hazard to human health or to the environment. Thus, TSCA specifies the registration requirements for the rotenone formulation constituents, other than the active pesticide ingredient.

Clean Water Act and the National Pollutant Discharge Elimination System (NPDES)

The discharge of toxic pollutants into the nation's waters is prohibited under the Clean Water Act (CWA). The CWA provides an integrated approach to protecting aquatic ecosystems and human health by regulating potentially toxic discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) permit, and by regulating ambient water quality through numeric criteria and narrative ('beneficial use') water quality standards defined in the California Toxics Rule (Fed Reg 65:No 97, 2000). Notably, no constituents in the rotenone formulations under consideration for use have promulgated numeric criteria for the protection of aquatic life, and only two constituents, toluene and trichloroethylene, have promulgated numeric criteria under the California Toxics Rule for human health (in both cases, the maximum estimated environmental concentrations in Lake Davis waters would fall well below the criteria). In California, the SWRCB, through the local Regional Water Quality Control Boards, administers the program and issues the NPDES permits. The release of aquatic pesticides into waters of any state may require an NPDES permit, depending on the pesticide considered, and the conditions proposed for application. The Ninth Circuit Court recently held that an NPDES permit is not required where a pesticide is applied intentionally, in accordance with label instructions, and there is no residue *or unintended effect* [emphasis added] (SWRCB 2005). Given that non-target aquatic animals would be impacted by the proposed rotenone treatment in Lake Davis and its tributaries, an NPDES permit will be required. The NPDES will specify conditions to prevent the permanent degradation of beneficial use designations for waters in Lake Davis and Big Grizzly Creek from rotenone treatment and neutralization, if such a chemical treatment alternative is selected for the removal of pike from the reservoir.

State of California

State Registration of Pesticides and Commercial Chemicals

California's programs addressing product registration of pesticides and commercial chemicals, licensing and certification, data review and evaluation, and pesticide residue monitoring closely parallel federal programs. However, California data requirements are stricter than federal requirements and are California-specific (e.g., manufacturers must prove their products are effective and can be used safely under California conditions). The registration of pesticides and commercial chemicals in California is under the purview of the California Environmental Protection Agency (CalEPA).

The California Department of Pesticide Regulation (CDPR), a department overseen by the CalEPA, coordinates a number of programs to regulate pesticides, to include product evaluation and registration through use enforcement, environmental monitoring, residue testing, and re-evaluation, if deemed appropriate. The CDPR works with county agricultural commissioners who act as local pesticide enforcement authorities and evaluate, condition, approve, or deny permits for restricted-use pesticides; certify private applicators; conduct compliance inspections; and take formal compliance or enforcement actions. California's pesticide regulatory program has been certified by the Secretary of Resources as meeting the requirements of CEQA (CDPR 2006).

The State of California also requires commercial growers and pesticide applicators to report commercial pesticide applications to local county agricultural commissioners. The CDPR compiles this information in annual pesticide use reports. Agricultural use comprises a vast majority of the total reported annual pesticide use while nonagricultural uses, like that associated with some of the project alternatives, comprise approximately 4 percent of the annual use. In addition to pesticide applications for fisheries management, other nonagricultural uses of pesticides include: pest control of right-of-ways, fumigation of nonfood and non-feed materials, pesticide research, and regulatory pest control in the ongoing control and /or eradication of pest infestations (CDPR 2003).

14.1.1.2 Human Health and Safety

Public and Worker Safety

While project personnel may be exposed during the proposed pesticide application activities, these receptors were not evaluated for potential human health risks in the risk assessment because the applicators are required to use formulated rotenone products in accordance with the product label, as approved by the USEPA. The product label includes requirements for the use of personal protective equipment for the individuals mixing and applying the formulations, for containing the material, for proper application, and for safe disposal of any material that is not applied. The project supervisor must have the authority to start and stop the rotenone application and be well versed in the state regulatory requirements regarding safe and legal use of the rotenone product, and applicator and public safety. Finally, all personnel involved with the rotenone application must receive safety training specific to the formulated rotenone product that will be used, and must follow the site safety and health plan developed for the project that will prevent exposure to rotenone and other formulation constituents at concentrations that could be expected to impact health.

At a minimum, specific safety training must include information on the following: (1) how to read and understand the product label; (2) the acute and chronic applicator exposure hazards; (3) routes and symptoms of pesticide overexposure; (4) how to obtain emergency medical care; (5) decontamination procedures; (6) how to use the required safety equipment; (7) safety requirements and proper procedures for pesticide handling, transportation, storage and disposal. The Training Records must be maintained in accordance with federal and state regulatory requirements.

Personal Protective Equipment (PPE) is required by the product label and material safety data sheet (MSDS) when using formulated rotenone pesticide products. MSDSs are required by the federal Occupational Safety and Health Administration (OSHA) to accompany all pesticides to be available for the use and protection of applicators. The MSDS provide information additional to the product labels on potentially hazardous ingredients in the product. This information is provided for the safety of the applicator who may be exposed to higher concentrations of the material than the general public could contact when the material is applied and dispersed according to the label instructions. The Department of Fish and Game (DFG) requires that MSDS be on site during applications.

OSHA sets permissible exposure limits (PELs) to protect workers against the health effects of exposure to chemicals in air. PELs are regulatory limits on the amount or concentration of a substance in the air. Inhaling chemicals that are above the PEL concentration during a work day may present a health concern. PELs are enforceable. OSHA PELs are chemical specific, and are based on an 8-hour time weighted average (TWA) exposure. PELs are established to protect the healthy adult worker. They are not applicable for the sensitive populations within the general public, such as children, youth, or nearby residents, who have the potential for continuous exposure over a 24-hour period for days in succession. If work conditions or situations are documented or anticipated to have concentrations of chemicals in air that are higher than the chemical specific PEL, then workers are required to use PPE in the form of respirators to protect them against inhaling potentially unhealthy levels.

Employees who are assigned to use respirator equipment must be included in the DFG respiratory protection program. This program requires all respirator users to complete a confidential medical questionnaire to be reviewed by a contracted medical professional. Once the medical contractor advises the DFG on the employees' capability to use respirator equipment, the employee must then complete respirator use training and fit testing. The fit testing and training must be repeated annually and records maintained.

The treatment plan for the Proposed Project and Alternatives A through D must always include an employee with first aid and CPR training. First aid supplies, an emergency eye wash shower and emergency plan procedures must also be present.

California-Specific Human Health Protective Standards and Guidelines

The State of California has also developed a series of standards and guidelines for evaluating the potential for adverse effects based on potential media concentrations for exposure. These standards include, but are not limited to: (1) California Action Levels for drinking water suppliers (advisory only), (2) Maximum Contaminant Level (MCL)—the maximum allowable concentration (i.e., standard) of a contaminant in drinking water, (3) California Human Health Screening Levels (CHHSLs)—guidance values that identify health protective concentrations of some 54 chemicals in air, soil, and water, (4) Public Health Goals (PHGs) identify health protective concentrations of chemicals in drinking water. MCLs must be set as close to the PHGs as is feasible, (5) Water Quality Goals (guidance) that provide concentrations of chemicals in waters of the state that are protective of the aquatic environment (both fresh and salt water) for aquatic species and humans that may consume the water and the aquatic species, (6) Proposition 65 is a regulation that identifies chemicals known by the state to cause cancer or reproductive toxicity – a safe harbor value is presented for each compound, and (7) Air Toxics Hot Spots program that identifies guidelines for acceptable concentrations of chemicals in air.

These regulatory guidance values are designed to be protective of the general public for long-term continuous exposures. In general, they address concentrations in environmental exposure media that may be contacted every day for a lifetime, which is termed a chronic (long term) exposure period. These values are based on toxicity criteria established by government regulatory agencies (e.g., USEPA and Cal/EPA) that include an uncertainty factor to be protective of sensitive subpopulations, in addition to the healthy workers addressed by OSHA standards as described above. Sensitive subpopulations include children,

the elderly, and those that may be health compromised. These criteria that address chronic long-term exposure are not relevant to the rotenone treatment alternatives for Lake Davis, since the piscicide components do not remain or persist in environmental media for extended periods of time. See Section 14.1.1.3 and Appendix J for more details on the environmental fate of rotenone and other piscicide components.

The Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) was enacted as a ballot initiative in November 1986. The proposition was intended by its authors to protect California citizens and the state's drinking water sources from chemicals known to cause cancer, birth defects, or other reproductive harm, and to inform citizens about exposures to such chemicals. Proposition 65 requires the governor to publish, at least annually, a list of chemicals known to the state to cause cancer or reproductive toxicity. The following chemicals are currently listed under Proposition 65 and are components of one or both of the liquid rotenone formulations: N-methyl pyrrolidone, naphthalene, toluene, and trichloroethylene (Cal/EPA 2006).

The regulation lists an allowable daily amount (presented in $\mu\text{g/day}$) that may be contacted for each listed chemical (Cal/EPA 2005). For the carcinogens naphthalene and trichloroethylene, the allowable amounts listed are based on the assumption that daily exposure to the compound occurs continuously over a 70-year lifetime. Since the Lake Davis Pike Eradication Project is a short-term project (up to 45 days), and exposure is for a short period, these values are not appropriate for screening for this project. See Appendix J, Section J.5.2.3.1 for more information on Proposition 65 screening values.

A programmatic EIS was previously prepared by the DFG that evaluated (and approved) the use of rotenone state-wide for fisheries management uses. That EIR also specified the requirement to conduct environmental impact assessments for all site-specific applications, to ensure that resources of local importance would be considered (DFG 1994). This latter requirement has ensured that the conditions unique to Lake Davis have been considered in the assessment of risks to human health and the environment from the proposed use of rotenone.

Hazards and Hazardous Materials in the Environmental Setting

Definitions of Hazards and Hazardous Materials

A "hazardous material" is defined in Title 22, California Code of Regulations, Section 66084, as "a substance or combination of substances which, because of its quantity, concentration or physical, chemical or infectious characteristics, may either: (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating irreversible illness, or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed." In essence, any liquid, solid, gas, sludge, synthetic product, or commodity that exhibits characteristics of toxicity, ignitability, corrosivity, or reactivity has the potential to be considered a "hazardous material." A "hazardous waste," in contrast, is simply defined as "any hazardous material that is abandoned, discarded, or recycled" (Title 22, California Code of Regulations [CCR] Section 66084).

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal health agency, based in Atlanta, Georgia that provides information about harmful chemicals in the environment and relays risk management information on how to reduce the risk of exposure to harmful levels of hazardous substances.

Hazards and Hazardous Materials in Rotenone Formulations Identified for the Proposed Project and Alternatives

The Proposed Project and four alternatives that involve commercial rotenone formulations require the use of hazardous materials as defined in CCR Section 66084. Hazardous materials in the rotenone formulations are summarized in Table 14.1-1 along with their expected aquatic concentrations when fully diluted in the receiving waters. Rotenone formulation constituents include the active ingredient (rotenone) and carrier solvents generally classified as “volatile organic compounds” (VOCs) and “semivolatile organic compounds” (SVOCs). These dispersant ingredients do not contribute to the toxicity of the rotenone by the same mechanism of action, but rather are added to the formulations to improve solubility, distribution and emulsification of the active ingredient during application in order to improve efficacy, (generally reducing the amount of active ingredient required). However, several of the VOCs and SVOCs ingredients in the rotenone formulations would be classified as hazardous materials under CCR 66084.

Table 14.1-1. International (CAS), National (EPA-RC) and State (CDPR) Registration Codes for Chemicals Detected in Rotenone Formulations Proposed for Use in Lake Davis Project Area

Chemical Name	Estimated Concentration in Treatment ¹	CAS #	EPA-PC #	CDPR Chemical Code
CFT Legumine® Formulation				
Rotenone (active ingredient)	42.1 µg/L	83-79-4	071003	518
Rotenolone	5.2 µg/L	None	None	4095
1-Methyl-2-pyrrolidinone (Methyl pyrrolidone)	87.8 µg/L	872-50-4	--	--
Diethylene glycol monoethyl ether (Diethylene glycol ethyl ether)	581.1 µg/L	111-90-0	011504	2505
1,3,5-Trimethylbenzene (mesitylene)	0.004 µg/L	108-67-8	None	5884
sec-Butylbenzene	0.004 µg/L	135-98-8	--	--
1-Butylbenzene (n-Butylbenzene)	0.078 µg/L	104-51-8	--	--
4-Isopropyltoluene (isopropyltoluene)	0.005 µg/L	98-87-6	--	--
Methylnaphthalene	0.136 µg/L	1321-84-4	054002	942
Naphthalene	0.341 µg/L	91-20-3	055801	421
NoxFish® Formulation				
Rotenone	48.81 µg/L			
Rotenolone	14.641 µg/L	None	None	4095
Trichloroethene (aka Trichloroethylene)	0.071 µg/L	79-01-6	081202	595
Toluene	1.757 µg/L	108-88-3	080601	1281
1,3- and/or 1,4-Xylene (M/p xylene)	0.595 µg/L	108-38-3/ 106-42-3	--	--
1,2-Xylene(o xylene)	0.074 µg/L	1330-20-7	086802	622
Isopropylbenzene	0.050 µg/L	98-82-8	None	3116
1-Propylbenzene(n-Propylbenzene)	0.303 µg/L	103-65-1	--	--
1,3,5-Trimethylbenzene (mesitylene)	0.839 µg/L	108-67-8	None	5884

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Chemical Name	Estimated Concentration in Treatment ¹	CAS #	EPA-PC #	CDPR Chemical Code
1,2,4-Trimethylbenzene	9.761 µg/L	95-63-6	None	5883
1-Butylbenzene (n-Butylbenzene)	8.785 µg/L	104-51-8	--	--
4-Isopropyltoluene (p-Isopropyltoluene)	0.976 µg/L	98-87-6	--	--
Naphthalene	68.326 µg/L (w/ EPA 8260)	91-20-3	055801	421
Potassium Permanganate (for Rotenone Neutralization)				
Potassium permanganate	4 mg/L-water	7722-64-7	068501	498

¹ Based on chemical analysis of commercial formulations and proposed treatment concentration of 1 mg-formulation/L receiving water, concentrations will vary by lot by approximately 10 percent. Data listed from DFG Pesticide Laboratory Reports (CFT Legumine[®]: report date 7/7/04, lab no P-2399; Noxfish[®]: report date 7/9/02, Lab Nos P-2297, 2298, 2300, 2302).

-- No data available

* EPA method 8260

^ EPA method 8270

Whether or not these or any hazardous substances are associated with adverse health effects depends upon the amount that is contacted by a receptor, and for what period of time that contact may occur (see toxicity discussion below). The intended receptor for a piscicide compound is the aquatic pest species, in this case, the northern pike in Lake Davis. The amount of piscicide that is allowed to be added to the water in the reservoir is determined by the USDA for this intended pesticide use. This EIR/EIS evaluation and the information in Appendix J regarding potential risks for humans and ecological species were prepared to evaluate if the proposed use of this piscicide presents unacceptable risks for humans or other unintended receptors that may contact the rotenone or other formulation constituents.

Rotenone is a restricted use pesticide due to its inherent aquatic toxicity and potential for acute toxicity when inhaled. Based on acute and subacute exposure conditions presented in the scientific literature, the EPA has classified rotenone as “practically non-toxic” to honeybees (via contact), “slightly toxic” to birds through oral routes of exposure, and “highly toxic” to mammals on an acute oral basis (EPA 2006). These categories are used to characterize hazards from all chemicals evaluated by the EPA. Essentially, they capture the range of doses that have been found to elicit adverse effects (see Appendix J, Table J-21 for dosage ranges by category). For aquatic applications as proposed, rotenone must be applied by Certified Applicators or persons under their direct supervision. As discussed, the Department of Pesticide Regulation regulates the procedures by which rotenone and other pesticides may be applied in this context (CDPR 2006, UC 2000).

Rotenone is commonly used to control insect pests on pets, on commercial food crops, on gardens and ornamental plants, fruit trees, and grains. According to a 1990 survey, it is among the most common natural (non-synthetic) organic pesticides purchased for home use (EPA 2002). Within the organic farming industry, rotenone (the powdered technical grade material) is approved for use on 91 different agricultural crops (USEPA 2006). In addition to the rotenone itself, some formulations of liquid rotenone also contain other compounds, some of which may not be approved for organic farming uses, but are approved for commercial crops. Within both the residential and commercial agricultural use categories, the labels for

rotenone products do not specify restrictions on the number of total applications that can be applied in a growing season, nor re-treatment intervals. Further, the application rates (on a surface area basis) greatly exceed that identified for aquatic use. Maximum label application rates for commercial agriculture are as high as 0.00875 lbs active ingredient (a.i.)/acre, and 0.3267 lbs/acre for residential applications (although actual residential use patterns may be as high as 2.91 lbs/acre for lawns). In their reevaluation of ecological risks from the agricultural use of rotenone, the EPA (2005) concluded that the acute and chronic risks were essentially insignificant at the approved commercial agricultural application rates. However, risk quotients, ratios between exposure doses divided by toxicity thresholds, may exceed 'levels of concern' for avian and mammalian wildlife at some residential application rates depending on the actual application rate applied, and the species considered.

Rotenone is toxic to fish and other gill-breathing organisms such as aquatic invertebrate nymphs and larvae and some forms of amphibians (DFG 2005). The aquatic toxicity of rotenone is due to the fact that it can move readily across the surface of the gills and into the circulatory system of the aquatic organism. It then moves directly to the cells and prevents their use of oxygen.

The U.S. Fish and Wildlife Service (USFWS) and USEPA have conducted substantial research to determine the safety of rotenone for fisheries management applications in the re-registration approval process (Finlayson et al. 2000, USEPA 2006). This research demonstrated the environmental and human safety of the use of rotenone according to label directions as a piscicide in fisheries management. Labels and fishery uses of rotenone have been studied extensively and successfully implemented. The data developed confirm that rotenone is a safe product when applied according to label instructions.

Although the USEPA and USFWS have determined that use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans (USEPA 1981, 1989, 2005), the DFG determined that concerns about potential impacts to *non-target* [emphasis added] human and ecological populations warranted further analysis through a screening level ecological and human health risk assessment (Appendix J). The risk assessment includes analysis of the potential hazards of the active ingredient (rotenone) as well as volatile and semivolatile solvents, emulsifiers and other dispersant ingredients that have been identified in the commercial formulations proposed for use. It reviews hazards due to direct toxicity and bioaccumulation potential. It also includes an assessment of the environmental fate of the compounds, including their partitioning within the environment, and rates and mechanisms by which the compounds naturally biodegrade so that they do not persist in the environment over long periods of time.

Potential Hazards from Dead Fish

The Proposed Project and alternatives were developed with the express purpose of pike eradication. During their decomposition the dead fish could serve as a source of odor, bacterial contamination, and treatment chemicals from bioconcentration. To address this risk, upon approval of a project, and prior to project implementation the DFG will develop a fish disposal plan to deal with the rapid and efficient removal of fish following the pike eradication project (see Section 2.3.5). The DFG estimates that approximately 100 tons of fish would be killed under all the alternatives except the No Project alternative. The plan will

specify methods to be used for fish removal and disposal. Disposal may be carried out through:

- Transfer to an approved landfill or other approved facilities
- Burial at an approved site, similar to landfill burial

Fish would be removed from the surface of the reservoir and from along the shoreline. With complete dewatering under Alternative E, the ability to retrieve nearly all dead fish is an opportunity not possible under the Proposed Project or the other alternatives.

It is expected that wildlife such as eagles, gulls, pelicans, herons, fox and raccoons would feed on some of the dead fish that are not retrieved during the removal process. Fish that sink to the bottom would not be generally available to avifauna and terrestrial wildlife, but would provide a source of nutrient addition and food to invertebrates and other fish in the reservoir that survive the pike eradication treatment. Fish carcasses are widely recognized as an important food source to support the detritus-base of aquatic systems (Garman 1992; Johnston et al. 2004).

The ingestion risks to these receptors from project-related hazardous materials that may bioconcentrate within these fish was evaluated through a food web ecological risk assessment model (Appendix J). Research has shown that fish killed by rotenone contain higher concentrations of the active ingredient than found in the exposure media (water). Therefore, in acute exposures, rotenone can be expected to *bioconcentrate* in the target organisms. However, neither rotenone, nor its breakdown product rotenolone (which is approximately 1/10 as toxic), biomagnify to result in higher concentrations up the food web. Metabolism and elimination of the pesticide is very rapid, and no bioactive metabolites that could be harmful to wildlife are produced in the metabolism of the compound. Ray (1991) indicates that approximately 20 percent of the applied oral dose and likely most of the absorbed dose is eliminated from animal systems within 24 hours of administration. In the food web model, using highly conservative input parameters for site use and sensitivity, the estimated doses to piscivorous birds and wildlife from rotenone exposure did not exceed acute or chronic toxicity thresholds, and are indeed safe for wildlife to consume. Further, past applications of rotenone have not identified significant impacts to avian or mammalian wildlife from piscicide applications (summarized in USEPA 2006). Potential impacts associated with ecological receptors feeding on dead fish is further discussed in Section 7.2.1.4.

Hazards from the Use of Potassium Permanganate as a Neutralizing Agent

Four options are under consideration for rotenone neutralization under the Proposed Project and alternatives that involve rotenone use (Section 2.3.4). With the exception of the natural attenuation option for neutralization (i.e., Option 1—‘Pumpback to Reservoir, No Neutralization’), all other options involve the use of potassium permanganate (KMnO₄). Potassium permanganate salt, also known as ‘permanganate of potash’, is a strong oxidizing agent used in many industries and laboratories. It is also used as a disinfectant, especially in the treatment process of potable water. It has been used effectively as a neutralizing compound for rotenone treatments for many years (EPA 2006; Ling 2003). For treatment of ectoparasitic and bacterial disease in fish, permanganate is often used at a concentration of 2 to 4 ppm for an indefinite period (i.e., continuous bath) until it breaks down (Cross and

Needham 1988). The concentration used for such bath treatments is within the range of that estimated for rotenone neutralization under the Proposed Project and treatment alternatives. Concentrations up to 25 mg/L have been used for short term (10 to 90 minute) dips to control such fish pathogens, but these concentrations are toxic if maintained for longer periods, potentially causing coagulative necrosis on the fins and gills. Thus, the ratio between the therapeutic and toxic concentrations is inherently low (i.e., it has a low ‘therapeutic index’).

Following rotenone application, in accordance with the neutralization options under consideration, KMnO_4 may be added to the water at ratios of between 2 and 4 parts KMnO_4 to each part of rotenone (EPA 2006). Because of the volume required and its moderate toxicity to fishes, this neutralizing compound may itself present a hazard to aquatic animals during application. Like rotenone, the toxicity of KMnO_4 differs among fish species, with toxicity reported by the EPA (2006) at concentrations of approximately 1 to 2 mg/L. Marking & Bills (1975) demonstrated that its toxicity was inversely proportional to water temperature for both rainbow trout and channel catfish. In the Marking and Bills study, the toxicity of potassium permanganate to green sunfish ranged from an absolute low of 1.14 to 4.08 mg/L, depending on the pH of the test solutions—although there was no clear pattern evident relative to pH. As reported in Section 7.1.2.4, 1.8 mg/L has been reported as toxic to rainbow trout (96-hr LC_{50}).

Although not as well studied, KMnO_4 is considered to be toxic to aquatic invertebrates, albeit slightly less than fish, with a 96-hour LC_{50} value 5 mg/L (Section 7.1.2.4; *see also* Appendix J, Section 3.6.2.3). However, as with vertebrates, there is likely a wide tolerance range among various freshwater invertebrates, and the range of tolerance among invertebrates potentially present in Big Grizzly Creek remains a source of uncertainty. Given its use as a therapeutic agent against fish ectoparasites (including ectoparasitic copepods) the potential exists that an impact to aquatic invertebrates is possible from the use of permanganate as a neutralizing agent. However, based on the estimated contact time and rapid dilution of the permanganate in the flowing system, significant adverse impacts are unlikely.

Potassium permanganate is produced by thermal oxidation of manganese dioxide (MnO_2) followed by electrolytic oxidation. In solid form, it is combustible and henceforth qualifies as a hazardous material. However, it would be used in liquid form which does not have this hazardous property. Manganese, the principal component by weight of permanganate, is ubiquitous in the environment (in soil, water, and rock) and comprises about 0.1 percent of the earth’s crust. The environmental chemistry and fate of manganese is controlled largely by pH. At pH values above 5.5 (approximately), colloidal manganese hydroxides generally form in water. Such colloidal forms are not generally bioavailable. As a strong oxidizing agent, permanganate is reduced when it oxidizes other substances. In the process, bioavailable oxygen is released, ionic potassium salt is liberated (an essential nutrient), and manganese dioxide is formed. Manganese dioxide is insoluble, hence not bioavailable, and chemically similar to the MnO_2 found in the earth’s crust (Vella 2006). Potassium permanganate will neutralize rotenone in 15 to 30 minutes, depending on water temperature.

Given its rapid reduction when mixed with organic matter (ubiquitous in natural water supplies) potassium permanganate does not pose a risk to groundwater contamination. Indeed, it is used second only to chlorine as a pre-treatment method for the removal of

organic contaminants such as naphthalene and tetrachloroethene (TCE) in potable groundwater wells according to a recent survey by the American Water Works Association (as cited in Vella 2006). In groundwater, its use helps to control iron, manganese, sulfides and color, and it can also be used to reduce high concentrations of radionuclides and arsenic (again, by forming insoluble colloids). Potassium permanganate is also used in surface water treatment plants, primarily for taste and odor problems.

Toxicity Concepts

Toxicology is the study of a chemical's potential to elicit an adverse effect in humans, animals, or plants. The toxicity of a pesticide or chemical is related to the specific amount of the compound taken into an organism's tissues (i.e., the dose received by the human or ecological 'receptor'), the duration of time over which a dose is received, the potency of the chemical for eliciting a toxic effect (i.e., the 'response'), and the sensitivity of the receptor receiving the dose of the chemical. Both carcinogenic and non-carcinogenic responses are measured in controlled laboratory tests to establish the toxicity of chemicals, although carcinogenic responses are considered only in human health risk assessment. The following discussion highlights some general concepts of importance in understanding how the potential toxicity hazards and risks of rotenone formulation and neutralization constituents were evaluated under the Proposed Project and treatment alternatives.

Carcinogen Toxicity

Evaluation of the potential for a chemical exposure to result in cancer is not included in ecological risk evaluations (see Section 14.2.2), but is part of the agency requirements for human health risk evaluations. For carcinogens, USEPA usually assumes a non-threshold response. That is, at every dose level of a carcinogen some people could be afflicted. In other words, not even very small doses are believed to be without some very small amount of risk. Common practice in human health risk assessment therefore relates carcinogen risk to a probability—where the probability of exceeding 10^{-6} chance of contracting cancer (i.e., one in a million) may be considered cause for concern. Recent studies, however, suggest that some potential carcinogens do indeed have a threshold dose. Currently, the USEPA does not consider any of the chemicals identified in the rotenone formulations proposed for use to exhibit a threshold dose for carcinogenicity. Therefore, evaluation of potential carcinogenic effects considered in Appendix J were not based on threshold doses.

Chemicals are classified as carcinogens based on the weight of evidence (WoE) from a review of available studies. Based on USEPA's 1986 "Proposed Guidelines for Carcinogen Risk Assessment," six weight-of-evidence categories exist:

- A: Human carcinogen (sufficient evidence of carcinogenicity in humans)
- B1: Probable human carcinogen (limited human data are available)
- B2: Probable human carcinogen (sufficient evidence in animals and inadequate or no evidence in humans)
- C: Possible human carcinogen (limited evidence of carcinogenicity in animals)

- D: Not classifiable as to human carcinogenicity
- E: Evidence of noncarcinogenicity for humans

If a chemical is classified as a class A, B or C carcinogen, then its *potency* for eliciting cancer is further examined. The potency of carcinogenic chemicals is generally expressed as a “cancer slope factor” (SF), or alternatively, as the “unit risk” (UR). The SF is the plausible upperbound estimate of the probability of a carcinogenic effect (response) per unit intake (dose) of a constituent over a lifetime. The SF is usually taken as the upper 95 percent *confidence limit* of the mean (average) slope of the dose-response curve developed for the carcinogen. Confidence limits are generally shown as dotted lines on either side of the dose-response curve when plotted as a graph. These confidence limit lines indicate the range within which the dose-response line would be expected to lie in 19 of 20 (i.e., 95 percent) tests conducted with the same population exposed to the carcinogen under the same conditions (e.g., same dose regime, route of exposure, etc.). The SF is expressed as inverse milligrams per kilogram per day $[(\text{mg/kg/day})^{-1}]$. In contrast, the UR is an expression of carcinogenic risk per unit concentration of the substance in the medium of exposure.

Non-carcinogen Toxicity

Non-carcinogenic effects are measured on a dose/response scale, whereby the probability of a toxic response (e.g., increased heart rate, respiratory complications, death, etc.) increases with the dose received. Thus, unlike the presumed carcinogenic response, a threshold dose level is assumed beyond which non-carcinogenic effects may occur. Non-carcinogenic responses are the only type of responses considered in ecological risk assessment whereas both carcinogenic and non-carcinogenic responses are considered for human health risk assessment.

Non-carcinogenic responses in both human and ecologically relevant populations are usually evaluated based on a comparison of an estimated dose received by an individual or “ecological receptor” (or “exposure point concentration” (EPC)), to a reference dose (RfD) for human health reference, or a toxicity reference value (TRV) for ecological reference. The RfD or TRV is a dose per unit body weight of receptor, or EPC, at or above which a toxicologically-based endpoint has been reported or promulgated into law (in simple terms, a comparison of the exposure dose to a toxicity threshold established in the scientific literature or in law—like water quality criteria). Typical TRVs include the Lowest Observable Adverse Effects Level (LOAEL)—the lowest dose or concentration of a chemical in a study, or group of studies, that has caused harmful health effects in people; and the LD₅₀—the median dose required to kill 50 percent of the population(s) studied. The LC₅₀ simply represents the same lethal effect, where the exposure route is through water or air. For sublethal effects, effects may be expressed as the ‘effective concentration’, or EC, with corresponding percentages listed to reference the proportion of the population to elicit the effect measured. For example, the EC₁₀ for increased heart rate following a chemical exposure, would indicate the concentration of the chemical that elicited the increased heart rate response in 10 percent of the population. For EC, LC, and LD responses, the confidence limits around the dose that elicits the response in 50 percent of the animals have the smallest confidence limits (i.e., the lowest levels of uncertainty in the prediction of the probability of a response).

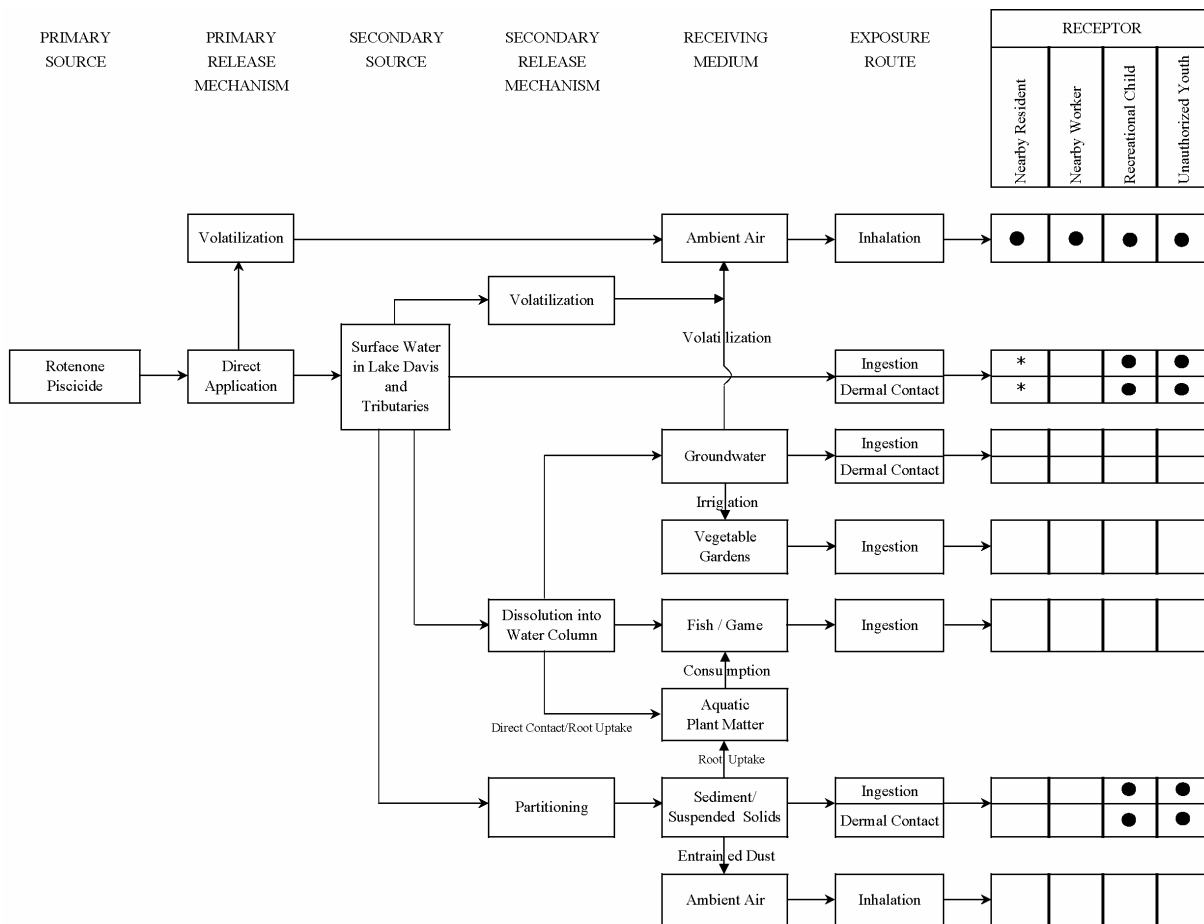
Toxic hazards can be mitigated by limiting potential exposure to ensure that doses received from intentional applications of chemicals are less than the amount that may result in adverse health effects.

Exposure

Exposure to chemicals and pesticides is required for toxic effects to occur. Exposure does not, in itself, imply that toxicity will result (as toxicity is a function of exposure, dose, potency, and sensitivity, as previously discussed); but it is a necessary first step for there to be a potential for an adverse health effect. In conducting ecological and human health risk assessments, the first step is to evaluate exposure routes, or 'pathways'. If this evaluation indicates that a significant exposure could occur, then an evaluation is made of the potential dose that could be received by an ecological receptor or human receptor population. There are three principal exposure pathways related to human and ecological risk assessment: breathing (i.e., inhalation), eating or drinking (i.e., ingestion), and getting something on the skin (i.e., dermal contact).

As part of the risk assessment process for the application of rotenone formulations in the Lake Davis project area, conceptual site exposure models (CSM) were developed to establish the chemical exposure pathways possible from the Proposed Project and alternatives involving treatment. The ATSDR defines a complete exposure pathway as having five parts: (1) source of contamination, (2) a transport mechanism via environmental media (e.g., air, water, soils, etc.), (3) an exposure point where the receptor(s) would encounter the contamination, (4) the receptor population(s) at the exposure point, and (5) the route of exposure at the exposure point by which the chemical would enter the tissues of the receptor population. The CSM identifies the human and ecological receptors that have the highest potential for exposure to rotenone formulations during and following the treatment project. Figure 14-1 illustrates the CSM for potential exposure to human populations. Figure 14-2 illustrates the CSM for the potential ecological receptors, as evaluated further in Appendix J.

HUMAN & ECOLOGICAL HEALTH CONCERNS



● Complete exposure pathway, quantitative evaluation.

* Currently this exposure pathway is incomplete because the reservoir is currently not serving as a domestic water supply. Rapid degradation of piscicide deems this pathway incomplete in the future (see Section 14.1.1.3 Environmental Fate and Transport) following refilling of the reservoir and future use as a domestic water supply. In addition prior to resuming using the reservoir as a domestic water supply a new treatment plant will be developed that would treat reservoir water prior to distribution for domestic use.

Blank box indicates incomplete pathway (i.e., chemicals below detection, no contact with medium, etc.)

Figure 14-1 Conceptual Human Exposure Model for Rotenone and Rotenone Formulation Constituents

		Ecological Receptor Guilds in the Lake Davis Project Area									
Chemicals of Potential Concern	Ecological Receptor Exposure Route	Passerine Robin, Wren	Upland Game Quail	Raptor Eagle	Waterfowl Mallard, Scaup	Omnivores Bear, Rat, Mouse	Herbivores Cottontail, Deer	Scavenger/Carnivores Fox	Livestock Cow, Calf	Amphibians Treefrog, Toad, Salamander	Reptiles Snake, Turtle
Rotenone & Formulation Constituents	Direct sediment ingestion	●	●	●	■	●	●	●	●	●	●
	Dietary accumulation from treated fish or aquatic insects	●	●	■	■	■	□	■	□	●	■
	Dietary accumulation from treated vegetation	●	●	□	■	●	■	□	■	□	●
	Direct ingestion of treated water	■	■	■	■	■	■	■	■	■	■
	Bioconcentration from dermal exposure	□	□	□	●	□	□	□	●	■	●
	Bioconcentration from inhalation	●	●	●	●	●	●	●	●	●	●
■ Likely a complete pathway □ Presumed incomplete pathway or not applicable ● Potentially complete, but likely insignificant											

Figure 14-2 Conceptual Ecological Exposure Model for Rotenone and Rotenone Formulation Constituents

As shown in Figure 14-1, the primary chemical exposure source is the application of rotenone formulations into Lake Davis and the secondary source is the spraying of formulation along the edge of the reservoir and application to tributary streams. Once released, the primary routes for formulation constituents to distribute into the environment would include:

- dissolution into reservoir surface water
- adsorption onto reservoir sediments
- adsorption onto aquatic and riparian vegetation
- volatilization of formulation constituents from the surface of the treated waters

Based on these routes, the possible ‘exposure points’ through which non-target ecological and/or human receptors could contact or otherwise receive “doses” of rotenone formulation constituents include: (1) via treated surface water, (2) via treated vegetation, (3) via sediment contact and/or ingestion, (4) via groundwater used for drinking, (5) via bioaccumulation from dead target organisms (i.e., fish), and (6) via inhalation of volatilized rotenone formulation constituents from the reservoir. Figures 14-1 and 14-2 show the possible exposure pathways to human and ecological receptors. The means by which exposure may occur for each of these receptor types is depicted in these figures and discussed in more detail in Appendix J.

For human receptors, the ingestion of surface water as reflected in Figure 14-1 relates to the incidental ingestion during water sports activities for the child camper or the unauthorized youth visitor either in the reservoir or downstream in Big Grizzly Creek. The nearby resident is not considered to have the potential for exposure to surface water as a drinking water source in this evaluation. Although developed as a drinking water source, the reservoir is not currently supporting this beneficial use. The new Plumas County Water Treatment Plant (PCWTP) may be on line in the fall 2007 if completed by that time. If a rotenone treatment is approved for pike eradication in Lake Davis, the reservoir’s waters would not be used as a drinking water supply until after the PCWTR is completed and post-treatment monitoring by DHS confirms its safety for public use and the absence of any measurable residues associated with the proposed treatment. Thus, the reservoir water would not be used for drinking by humans during the period when rotenone treatment and neutralization activities associated with the project alternatives could impact drinking water quality.

Exposure from consumption of groundwater from wells in the vicinity of Lake Davis or from City of Portola wells is unlikely. See Section 4.2.4 for an analysis of the potential for groundwater contamination and Appendix J, which conclude that groundwater is not a likely exposure pathway. Nevertheless, groundwater monitoring programs are being continued and refined, in consultation with, and as required by, the California Department of Health Services, Regional Water Quality Control Board, and in consultation with Plumas County Environmental Health as described in Section 4.1.1.3.

14.1.1.3 Pesticides and the Environment

Environmental Fate and Transport

Addressing the full spectrum of the behavior of a chemical released into the environment requires an analysis of the chemical(s) fate and transport. Fate and transport analysis allows for an interpretation of the potential persistence of chemicals in the environment, and the means by which they may be transported from one environmental ‘compartment’ (e.g., soils) into another (e.g., biological tissues), or otherwise transformed through degradation. A variety of biological, chemical and physical mechanisms affect the persistence of a chemical in the environment, and certain physical and chemical parameters allow for a reasonable prediction of such environmental fate. Typical measures by which the fate and transport of chemicals are evaluated include:

- Half-life in soils, sediments, water, air
- Relative solubility in water versus lipid (fat)
- Adsorption onto soils, sediments, biological tissues (e.g., plant matter)
- Volatilization rate across the air-water interface
- Photolytic half-lives (i.e., degradation/oxidation by sunlight)

Of course, the environmental fate and transport of chemical(s) is also regulated by physical conditions in the environment where the chemical was initially released. Factors of particular relevance that affect fate and transport processes include:

- Temperature
- Wind convection
- Sunlight penetration
- Turbidity (i.e., in water applications)
- pH

The rate and manner in which these natural physical processes affect the breakdown or persistence of a chemical in the environment is chemical specific. Appendix J, Sections J.3.3 and J.3.3.6 discuss the environmental fate of rotenone and other chemicals associated with the piscicide formulations proposed for use for the project alternatives. All of these chemicals have characteristics that make them break down rapidly in the environment, and they are not expected to be present in environmental media for extended periods of time. Using currently available sampling and analytical tools and following EPA protocols, rotenone and many of the other compounds in the pesticide formulations proposed would not be detectable in water, sediment, or air after just a few days to weeks following the proposed treatments. (Maximum conservative estimates in sediment for rotenone are assumed to persist for no longer than 45 days, and likely significantly less).

Transformation, Bioconcentration, Bioaccumulation and Biomagnification

Once released into the environment chemicals may also be transformed through biological and/or chemical processes into other chemicals as part of their degradation, or preferentially distributed into specific environmental media or compartments based on their propensity to degrade or bioaccumulate. For organic chemicals, full degradation is considered that point at which a chemical has fully degraded down to its elemental forms and carbon dioxide.

Bioconcentration and *bioaccumulation*, in contrast, reflect a translocation process whereby chemicals are taken up from contaminated media into biological tissues. Bioconcentration is the process whereby a chemical enters an organism from the water, either across the gills or epithelial (skin) tissue, and is concentrated in the tissues to a level greater than that dissolved in water. Bioaccumulation represents a similar process, in that the concentration ultimately taken up by an organism is greater than that found in the media; however, the term encompasses uptake from both water and food exposure pathways. *Biomagnification* represents the case wherein a contaminant becomes progressively more concentrated in the food web, as the trophic level increases (e.g., an eagle containing more contaminant than the fish it eats, which in turn contains more than found in the invertebrates it eats). In the case of the rotenone formulations proposed for use, some constituents have been found to bioconcentrate (e.g., rotenone, naphthalene) but none have been found to bioaccumulate or biomagnify.

14.1.2 Regulatory Setting

The USEPA and CDPR evaluate pesticides for potential effects on human health prior to registration and require appropriate use restrictions to be present on the pesticide label to ensure a reasonable certainty of no harm to human health and the environment. CDPR's pesticide registration process has been certified as meeting the requirements of CEQA. Application in compliance with pesticide labels ensures that pesticides used in the project would not be detrimental to the public health and safety. CDPR enforces state and federal regulations that govern the safe and proper use of pesticides including licensing of dealers and applicators, investigating pesticide incidents, ensuring product quality, and monitoring pesticide residues on commercial produce. The county agricultural commissioners and their staff carry out enforcement activities with training, coordination, oversight, and technical and legal support provided by state staff.

The Environmental Hazards Assessment Program (EHAP) of CDPR has the lead role in implementing CDPR's environmental protection program. EHAP collects data and analyzes the results from studies that are conducted to measure pesticide residues in the environment, characterize drift and other off-site pesticide movement, and evaluate the effect of application methods on movement of pesticides in air. If a pesticide is determined to be a toxic air contaminant, appropriate control measures are developed to reduce emissions to levels that adequately protect public health. This is done in consultation with the California Air Resources Board (CARB). Control measures may include product label amendments, applicator training, restrictions on use patterns or locations, and product cancellations.

State and local agency regulatory responsibilities related to the protection of human and ecological health from potentially contaminated environmental media (air, water, sediments) include:

- **State Water Quality Control Board (SWRCB)/Regional Water Quality Control Boards (RWQCBs):** are responsible for protecting the quality of the waters of the state for present and future beneficial uses. Plumas County, Lake, Davis, and the City of Portola fall within the Central Valley RWQCB. The Central Valley RWQCB has established narrative beneficial uses for the protection of surface water in their Basin Plan. Risk-based numeric criteria specify the concentrations of some constituents that are protective of aquatic life and other narrative beneficial uses such as ‘drinking water supply,’ as is recognized for Lake Davis. Under the non-degradation policy adopted by the SWRCB policy (resolution 68-16), whenever the existing quality of water exceeds the quality necessary to maintain present and potential beneficial uses of the water, existing water quality must be maintained. This policy pertains to both surface waters and groundwater of the state.
- **The Department of Health Services (DHS):** Health and Safety Code Section 116751 prevents the DFG from introducing a pesticide into surface or groundwater drinking supplies unless the DHS determines the activity will not have an adverse impact. The DHS is responsible for evaluating the short- and long-term effect(s) of pesticide use on water quality and for ensuring alternative water supplies are available during pesticide applications that may contaminate drinking waters. Health and Safety Code 11675 requires a standard of ‘non-detect’ for formulation constituents for their approval of safety. The DHS also has the authority to set non-regulatory advisory levels, such as the “notification levels” for some of the inert ingredients in the rotenone formulations.
- **Office of Environmental Health Hazard Assessment (OEHHA):** The Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) was enacted as a ballot initiative in November 1986. The proposition was intended by its authors to protect California citizens and the state’s drinking water sources from chemicals known to cause cancer, birth defects, or other reproductive harm, and to inform citizens about exposures to such chemicals. Proposition 65 requires the governor to publish, at least annually, a list of chemicals known to the state to cause cancer or reproductive toxicity. The following chemicals are currently listed under Proposition 65 and are components of one or both of the liquid rotenone formulations: N-methyl pyrrolidone, naphthalene, toluene, and trichloroethylene (Cal/EPA 2006).

The regulation lists an allowable daily amount (presented in µg/day) that may be contacted for each listed chemical (Cal/EPA 2005). For the carcinogens naphthalene and trichloroethylene, the allowable amounts listed are based on the assumption that daily exposure to the compound occurs continuously over a 70-year lifetime. Since the Lake Davis Pike Eradication Project is a short-term project (up to 45 days), and exposure is for a short period, these values are not appropriate for screening for this project. See Appendix J, Section J.5.2.3.1 for more information on Proposition 65 screening values.

- **Plumas County Department of Health (PCDH):** At the local level, the DHS delegates the oversight of drinking water quality to the Plumas County Department of Environmental Health (PCEH). The PCEH is responsible for ensuring the quality of drinking water for small municipalities (<200 homes). PCEH undertook the collection and monitoring of wells near Lake Davis following the 1997 reservoir treatment and will

be actively involved in ensuring the public safety of well water following the proposed treatments, if approved.

- Northern Sierra Air Quality Management District (NSAQMD):** Lake Davis and the project area lie within the NSAQMD, which includes Nevada, Plumas, and Sierra counties. The NSAQMD has regulatory responsibility for monitoring compliance with federal and state Ambient Air Quality Standards. The Environmental Protection Agency (USEPA) established the National Ambient Air Quality Standards (NAAQS) for the “criteria” pollutants regulated by the NSAQMD to protect human health (primary standards) and public welfare (secondary standards, such as damage to vegetation). California established its own set of ambient air quality standards (CAAQS) for the criteria pollutants (see Section 5, Table 5.1-1). These criteria pollutants include the non-hazardous constituents commonly resultant from fuels combustion such as ozone, sulfur dioxide, and carbon monoxide and are therefore applicable to the air quality analysis of combustible emissions from the Proposed Project (Section 5). Hazardous pollutants, the focus of this section, are regulated under the National Emissions Standards for Hazardous Air Pollutants (NESHAPs), codified in 40 CFR Parts 61 and 63. Standards for some of the components detected in the rotenone formulations (e.g., benzene) are addressed in the NESHAP.

14.1.2.1 Transport, Use and Disposal

The California Code of Regulations (CCR), Title 3, specifies requirements for proper storage, transportation, and disposal of pesticides and containers. CDPR and the county agricultural commissioners are responsible for enforcement. Pesticide labels provide instructions for proper handling, storage, and disposal of pesticides, as required by the USEPA.

14.1.2.2 Worker Health and Safety

CCR Title 3 includes pesticide worker safety regulations that specify safe work practices for employees who handle pesticides. The CCR also specifies label and warning requirements that must be met prior to pesticide application. CDPR and the local agricultural commissioner enforce the worker safety regulations. Pesticide applicators receive annual training that includes routine and emergency decontamination procedures, safety requirements for handling pesticides, and emergency first aid. The Pest Management and Licensing Branch administers CDPR’s Licensing and Certification Program which is responsible for examining and licensing pest control operators and advisors, and for certifying pesticide applicators who use or supervise the use of registered pesticides.

14.2 Environmental Impacts and Consequences

This section evaluates the potential impacts from the Proposed Project and treatment alternatives, focusing on the human health and environmental concerns specific to the use of hazardous materials in the rotenone formulations and the neutralizing agent (potassium permanganate) that could be applied. Impacts on ecological and human health from other project actions, such as the effects from reservoir drawdown alternatives on habitat and food

supply, are considered in specific biological resource sections (e.g., Sections 7.1, 7.2, and 7.3).

14.2.1 Evaluation Criteria and Environmental Concerns

The principal environmental concerns associated with the proposed use of hazardous materials and the generation of hazardous wastes broadly considered in this analysis relate to the protection of: (1) ecological health, and (2) human health and safety.

CEQA Guidelines (Appendix G of the Guidelines), outline evaluation ‘criteria’ for considering human and ecological health (HEH) concerns related to the use and/or production of hazardous materials and/or wastes. Using these CEQA criteria that would be applicable, the Proposed Project and alternatives were examined to determine whether they would:

- Produce hazardous emissions or require the handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?
- Create a significant hazard to the public or the environment through the routine transport, use or disposal of hazardous materials?
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?
- Be located on a site which is included on a list of hazardous materials sites and, as a result, would it create a significant hazard to the public or the environment?
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?
- Impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan?
- Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

With respect to these above CEQA criteria, the following conclusions can be made that are applicable to the No Action, Proposed Project, and *all* project alternatives under consideration. For the reasons below, no further analysis is provided in Section 14.2:

1. There are no registered schools within a 0.25-mile radius of Lake Davis. C. Roy Carmichael Elementary School, the closest school to the project area, is located on Lake Davis Road about five miles from Lake Davis (Figure 14.3) in the Big Grizzly Creek watershed. Haul routes would not pass within 0.25 mile of the school.
2. The project area is not within an airport use plan or within the vicinity of a known private airstrip and it is not within two miles of an airport (DFG 2005). Therefore, hazardous materials associated with the project alternatives would create no significant impact to these public resources.

3. Neither Lake Davis nor the PNF are registered as a hazardous waste site, nor is one contained within the project area boundaries. Review of land uses in the project area suggests that the closest hazardous waste site to the project area is the inactive Walker Mine, located seven miles northwest of the reservoir in a different watershed.
4. The Proposed Project and all alternatives except the No Project and Alternative E consider the use of rotenone formulations that are labeled as flammable, and hence must be considered as a possible source for combustible material that could, if improperly used, provide a source for wildfire. The project area lies within a National Forest, and the risk of wildfire is addressed in Public Services Section 13.2.4.2 which contains an analysis of emergency events and the impacts on emergency services.

The remaining analysis focuses on the ecological and human health concerns more applicable to the Proposed Project, as outlined in Section 1.7.3, namely:

- Effect of use and transport of rotenone and its formulation constituents on human populations;
- Effect of spill of rotenone and its formulation constituents on ecological and human populations; and
- Effect of rotenone and its formulation constituents on fish and wildlife species.

14.2.1.1 Thresholds of Significance for Impacts

Enforceable criteria are those established by federal or state agencies to be protective of human and/or ecological health were used as the default thresholds for interpreting whether a potentially adverse impact was significant to human or ecological health. In the absence of such criteria, health-based *guidance levels* proposed by federal or state agencies as protective of human and ecological health were used, when appropriate for the short-term exposure period associated with this Proposed Project. If appropriate regulatory or guidance values were not available, such values were developed according to regulatory guidance for evaluating risks for exposure to chemicals in the environment. See discussions below and in Appendix J (Section J.5.2.1) for derivation of Health Based Screening Levels (HBSLs). As detailed in 14.2.2, estimated environmental exposure concentrations or “doses” were compared against these criteria and guidance levels. Based on the above qualifications, an impact from the proposed use of hazardous materials (in the rotenone formulations) was considered adverse and significant if the Proposed Project or alternatives would:

- Result in an exceedance of federal or state agency surface or groundwater quality standard or water quality objective (particularly waters that may drain to wetlands or streams) for a chemical found in the rotenone formulations.
- Result in an exceedance of a literature based toxicity reference value (i.e., threshold) for aquatic toxicity in aquatic animals.
- Result in an exceedance of a literature-based toxicity reference value for ingestion and/or inhalation uptake in relevant terrestrial or avian wildlife.
- Result in an exceedance of regulatory guidance or human health based screening level for inhalation risk.

- Expose the public, especially schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) to substantial pollutant concentrations, including those resulting in a cancer risk greater than or equal to one in a million, or a Hazard Index for non-cancerous risk of greater than or equal to 0.1.
- Cause a spill or leak that would contaminate the soil or waters to the extent of eradicating the existing vegetation, inhibiting revegetation, or migrating to other areas and affecting soil and/or aquatic ecosystems via erosion and/or sedimentation.
- Create a potential health hazard or involve the use, production, or disposal of materials in a manner that would be expected to pose a hazard to wildlife or aquatic life in the project area (i.e., where hazard would be considered likely if the estimated dose received by wildlife receptors exceeds pertinent toxicity reference values).
- Create a potential health hazard or involve the use, production, or disposal of materials that pose a hazard to a special-status species population in the project area.

14.2.2 Evaluation Methods and Assumptions

A screening level ecological and human risk assessment was the principal method used to evaluate human and ecological health concerns associated with the hazardous materials use that is considered under the Proposed Project and the other treatment alternatives (Appendix J).

The evaluation of human health and ecological risks followed established regulatory guidance designed to evaluate the presence of chemicals in the environment and their potential for adverse health effects when those chemicals are contacted (USEPA 1991, USEPA 1998; CalEPA 1996). For humans, both cancer and noncancer risks were considered. For ecological risks, only non-cancer risks were considered, as the state of the science does not permit a reliable interpretation of the effects of the environmental chemicals on cancer incidence in animals. In brief, these methods involve: (1) an analysis of the toxicity hazards identified from the scientific literature, (the ‘hazard assessment’) (2) an analysis of potential exposure in humans and ecological receptors from air, sediment, water and/or food (the ‘exposure assessment’), and (3) a comparison of exposure to toxicity (the ‘risk characterization’).

The environmental exposure concentrations (doses) to hazardous materials in the rotenone formulations were estimated for the exposure assessment from past empirical monitoring results following the 1997 Lake Davis treatment, or from modeling. Results from past empirical monitoring after the 1997 treatment are also used in Appendix J (see Sections J.3.3.2 and 3.6) to evaluate the environmental degradation and transport of formulation constituents that could be found in the formulations considered for use presently.

Water concentrations were estimated based on the assumption of complete mixing of rotenone and the rotenone formulation constituents identified in the undiluted commercial products. These estimated concentrations are depicted in Table 14.1-1. Although the chemical analyses of the neat (undiluted) formulations summarized in this table suggest rotenone would be in the reservoir at a concentration less than 50 ppb with a 1 ppm formulation reservoir treatment (i.e., for CFT at 42.1 ppb, for Noxfish[®] at 48.81 ppb), the analysis conservatively assumed that 50 ppb would be the actual concentration based on the

commercial label indications that the undiluted formulations will, on average, contain 5 percent rotenone. This assumption is consistent with Section 2, and is ultimately more conservative for the risk assessment than if the values for rotenone in Table 14.1-1 are used. For other formulation constituents, the values represented in Table 14.1-1 are used. Further chemical properties used to evaluate environmental degradation and transport of the formulation constituents are provided in Appendix J (Table J-15).

Air concentrations of volatile and semivolatile constituents in the formulations, volatilized from the water after treatment dispersion in the reservoir were modeled using the 'Screen3' model, a conservative 'box' model used to project 'worst case' air concentrations of chemicals volatilized from water (USEPA 1995). This is an EPA approved method of estimating air concentrations. This evaluation method is designed to overestimate potential air concentrations, and is conservative because the predicted concentrations are likely to exceed any actual concentrations that may be experienced in the actual treatment scenarios. Consequently, actual exposures are likely to be less than predicted, and may be significantly less. This approach is used in order to be sure that the general public and ecological receptors are being adequately evaluated and protected, and it is consistent with the CEQA practices to perform worst-case impact analyses. Although likely to greatly overestimate air concentrations, the EPA has assumed that results from Screen3 are considered valid for short-term concentration estimates under a variety of meteorological conditions. For the Proposed Project and treatment alternatives, the Screen3 modeling assumed that:

- Rotenone formulation constituents were completely mixed in the reservoir);
- Maximal phase separation occurred between the air:water interface (i. e., based on chemical specific properties, as much as is physically possible is assumed to leave the water and enter the air);
- Constituents in the reservoir did not undergo *any* chemical reactions such as hydrolysis or photolysis in the reservoir before volatilization that would essentially reduce their concentration (this overestimates the air concentrations as these natural processes will occur to reduce the chemical concentrations in the air);
- Lake Davis was essentially a rectangular box, with a source height (i.e., point of release) of 1 cm (this low height means that there is minimal dilution assumed from the surrounding air in the source area, and increases the estimated air concentration required to be protective);
- Air concentrations are assumed to flow downgradient, with a human receptor height of 1.5 meters (downgradient continuous flow without changing wind direction maximizes the estimated concentration for the downgradient receptor at their breathing height of 1.5 meters); and
- Distribution and dilution of all treatment chemicals would be conducted in one 10 hour day, as opposed to two or three days, a time period also captured under the project description in Section 2, and considered much more likely by the DFG due to the logistics inherent to treating the large body of water (the longer distribution period would reduce the maximal concentrations of volatile compounds emitted from the reservoir substantially).

Of note, modeling of chemical mixing and fate in the reservoir would be necessary to conduct more complex air dispersion modeling using ISCS3T (USEPA 2002), which could improve the accuracy of the air concentration estimates projected by Screen3. For a first look at human health inhalation risk, however, the Screen3 modeling results were considered as a suitable conservative (i.e., health protective) model for initial examination. In general, sampling of environmental media under similar conditions to the Proposed Project is likely to be a better indicator of potential exposures than modeling. Past air and surface water monitoring results from the 1997 treatment with Nusyn-Noxfish[®], which contains essentially the same inert dispersant mixture as the proposed Noxfish[®] (minus the synergist PBO) suggests that the Screen3 model may be greatly exaggerating acute air concentrations of some volatile compounds by not taking into account dispersion and natural degradation factors. These results are examined further in Appendix J, Section J.3.6. However, air monitoring conducted in 1997 did not initiate until three days after the treatment commenced, and sample locations were limited. Thus, possible peak concentrations may have been missed in the monitoring. Further, no evaluation of components in CFT Legumine[®] was conducted at that time, as that formulation was not used. Given these factors, it was considered necessary to use Screen3, a generalized and conservative model that would capture the ‘worst-case’ acute (1 hr and 24 hr average) concentrations of air constituents from both formulations in order to provide a comparison of the potential inhalation risks of the two formulations.

The potential for exposure to rotenone formulation and neutralization constituents via groundwater and sediment was estimated from past monitoring data obtained after the 1997 treatment of Lake Davis (Finlayson et. al. 2001), and qualitatively from the environmental properties of the chemicals. Additional groundwater monitoring data collected by DHS are presented in Section 4, Tables 4.1-2 and 4.1-3. These data sets provide perspective on the potential environmental transport and degradation of formulation constituents from dispersant ingredients in Noxfish[®], but were of limited use in characterizing groundwater and sediment exposure risks from the inert ingredients in CFT Legumine[®] because this product was not used in the 1997 treatment. For the latter product, risk conclusions were principally based on an assessment of the physical chemistry of the formulation components (see Appendix J, Table J-15; Section J.3.3.2)

Human Populations

Potentially sensitive human populations were identified through the Conceptual Site Model (Figure 14-1) and are summarized in Table 14.2-1. Figure 14-3, Sensitive Land Uses, reflects distances from Lake Davis of potentially sensitive land uses such as schools and hospitals within and adjacent to the project area. Figure 14-4, Sensitive Populations, shows the potential population within 1,000 to 2,000 meters of Grizzly Valley Dam. Human exposure doses were estimated from the empirical and/or modeled air, water, and sediment data and then compared directly against health based screening values for carcinogenic and non-carcinogenic risks, as fully discussed in Appendix J.

FIGURE 14-3

FIGURE 14-3 BACK

FIGURE 14-4

FIGURE 14-4 BACK

Table 14.2-1. Human Receptor Populations in Project Area with Complete Exposure Pathways

Exposure Population	Exposure Pathways
Nearby Residents (downwind of Lake Davis)	Inhalation of vapors during direct application of piscicide and from surface water following application activities.
Nearby Workers (downwind of Lake Davis)	
Recreational Child Camper	Inhalation of vapors during direct application of piscicide and from surface water following application activities.
Unauthorized Youth	Incidental ingestion and dermal contact with surface water and sediment.

A human health carcinogenic risk assessment evaluates conditions going forward in time as an estimate of increased cancer risk or hazard – the probability of an adverse health effect occurring. It does not diagnose illness, evaluate the medical condition of specific individuals, or predict the actual occurrence of disease states. For the human health evaluation, the target cancer risk for the protection of public health was set at the lower end of the acceptable regulatory range, or a one in a million increased risk of cancer. For non-carcinogenic threshold effects, the ‘hazard index’ of one was used for human exposure comparisons.

The Conceptual Site Model (CSM), (Figure 14-1) in conjunction with information regarding the environmental setting of the site, identified the following complete exposure pathways.

These human receptor populations in Table 14.2-1 were further evaluated in the risk assessment (Appendix J) to determine if exposure to environmental media potentially contaminated by rotenone formulations could be significant, and/or whether exposure need be mitigated or project activities adjusted to reduce or eliminate these exposures.

Ecological Receptors

For the ecological risk assessment, exposure to rotenone via bioconcentration from surface water was considered complete in all aquatic and amphibious animals in the Project Area. Complete exposure pathways were also assumed for the ingestion and inhalation exposure pathways for some wildlife species (Figure 14-2). For aquatic species, the projected rotenone concentration was compared against the reported aquatic sensitivity of rotenone to an extensive list of fish, aquatic invertebrates, and select amphibians. Thus, the ‘dose’ received to these animals was presumed to be an integration of that taken up by the aquatic animal across the gills and skin via bioconcentration. The methodology for estimating ingestion doses in wildlife is described in Appendix J. To address wildlife risks from inhalation exposure to formulation constituents, the Screen3 modeled concentrations were compared directly against acute threshold values outlined in Appendix J, Table J-16.

To characterize the risks to the range of fish and wildlife examined, the estimated exposure doses were then compared against toxicity thresholds by calculating the ‘hazard quotient’ (HQ). The HQ is derived by dividing the estimated exposure dose by the relevant toxicity threshold. Tables 14.2-2 and 14.2-3 summarize the hazard quotient calculations for aquatic and terrestrial wildlife potentially exposed to rotenone and the major formulation

**Table 14.2-2. Hazard Quotient and Level of Concern Indices Estimated for
Aquatic Receptor Organisms Inhabiting Lake Davis¹**

Class			Rotenone TRV				Reference
	Species	Surrogate species	Test end point	TRV value (µg/L)	Hazard Quotient (HQ)	Level of Concern (LOC)	
Amphibian	Pacific treefrog (adult)	Northern leopard frog (adult)	LC ₅₀ 24h	240	0.208	0.5	1
	Pacific treefrog (larvae)	Northern leopard frog (tadpole)	LC ₅₀ 24h	5	10	0.5	2
	Western toad (adult)	Northern leopard frog (adult)	LC ₅₀ 24h	240	0.208	0.5	1
	Western toad (larvae)	Northern leopard frog (tadpole)	LC ₅₀ 24h	5	10	0.5	2
	Long-toed salamander	Tiger salamander (larvae)	LC ₅₀ 24h	5	10	0.5	2
Fish	Northern pike		LC ₅₀ 24h	2.3	21.74	0.5	3
	Rainbow trout		LC ₅₀ 24h	3.5	14.29	0.5	3
	Largemouth bass		LC ₅₀ 24h	10	5	0.5	3
	Pumpkinseed	Green sunfish	LC ₅₀ 24h	10.9	4.59	0.5	3
	Brown bullhead	Black bullhead	LC ₅₀ 24h	33.3	1.5	0.5	3
	Golden shiner	Common carp	LC ₅₀ 24h	4.2	11.9	0.5	3
Macroinvertebrate	Flatworm	<i>Catenula</i> sp.	LC ₅₀ 24h	5100	0.01	0.5	4
		<i>Planaria</i> sp.	LC ₅₀ 24h	<500	<0.1	0.5	4
	Annelid worms	Leech	LC ₅₀ 48 h	<100	<0.5	0.5	4
	Copepod	<i>Cyclops</i> sp.	LC ₁₀₀ 72h	<100	<0.5	0.5	4
	Branchiura	<i>Argulus</i> sp.	LC ₅₀ 24h	~25	~2	0.5	4
	Cladoceran	<i>Daphnia pulex</i>	LC ₅₀ 24h	27	1.85	0.5	4
		<i>D. pulex</i>	LC ₅₀ 24h	<25	<2	0.5	4
		<i>Diaptomus siciloides</i>	LC ₅₀ 24h	<25	<2	0.5	4
	Conchostracan	<i>Estheria</i> sp.	LC ₅₀ 24h	~50	~1	0.5	4
	Freshwater prawn	<i>Palaemonetes kadiakensis</i>	LC ₅₀ 24h	5150	0.01	0.5	4

Table 14.2-2. Hazard Quotient and Level of Concern Indices Estimated for Aquatic Receptor Organisms Inhabiting Lake Davis¹

Class			Rotenone TRV				Reference
	Species	Surrogate species	Test end point	TRV value (µg/L)	Hazard Quotient (HQ)	Level of Concern (LOC)	
Macroinvertebrate (continued)	Crayfish	<i>Cambarus immunis</i>	LC ₅₀ 72h	>500	>0.1	0.5	4
	Dragonfly naiad	<i>Macromia</i> sp.	LC ₅₀ 24h	4700	0.011	0.5	4
	Stonefly naiad	<i>Pteronarcys californica</i>	LC ₅₀ 24h	2900	0.017	0.5	4
	Backswimmer	<i>Notonecta</i> sp.	LC ₅₀ 24h	3420	0.015	0.5	4
		<i>Notonecta</i> sp.	LC ₅₀ 24h	~100	~0.5	0.5	4
	Caddis fly larvae	<i>Hydropsyche</i> sp.	LC ₅₀ 96h	605	0.083	0.5	4
	Whirligig	<i>Gyrinus</i> sp.	LC ₅₀ 24h	3550	0.014	0.5	4
	Water mite	Hydrachnidae	LC ₅₀ 96h	~50	~1	0.5	4
	Snail	<i>Physa pomilia</i>	LC ₅₀ 24h	6350	0.008	0.5	4
		<i>Oxytrema catenaria</i>	LC ₅₀ 96h	1750	0.029	0.5	4
		<i>Lymnaea stagnalis</i>	LC ₅₀ 96h	>1000	>0.05	0.5	4
	Bivalve Mollusc	<i>Dreissena polymorpha</i>	LC ₅₀ 48h	2190	0.023	0.5	4
		<i>Obliquaria reflexa</i>	LC ₅₀ 48h	>1000	>0.05	0.5	4
		<i>Elliptio buckleyi</i>	LC ₅₀ 96h	2950	0.017	0.5	4
		<i>Elliptio complanata</i>	LC ₅₀ 96h	2000	0.025	0.5	4
		<i>Corbicula manilensis</i>	LC ₅₀ 96 h	7500	0.0067	0.5	4
	Ostracod	<i>Cypridopsis</i> sp.	LC ₅₀ 24h	490	0.1	0.5	4

References: 1. Farringer, 1972; 2. Hamilton, 1941; 3. Marking & Bills, 1972; 4. Various, summarized by Ling, 2003.

¹HQ index based on a rotenone concentration of 50µg/L or 50 parts per billion (ppb)

Table 14.2-3. Wildlife Hazard Quotients From Combined Ingestion Exposure Pathways

Class	Species	Tox. test	CFT Legumine®					Noxfish®					Level of Concern (LOC) ^g
			Rotenone (50ppb) ^a [High / Average]		Diethylene Glycol Monoethyl Ether ^b	1-Methyl-2-Pyrrolidinone ^c	Naphthalene (0.341ppb) ^d	Rotenone (50ppb) ^a [High / Average]		Naphthalene (68.326ppb) ^d	Toluene ^e	1,2,4 Trimethylbenzene ^f	
Avian	American robin	NOAEL	0.501	0.501	0.001	0.0001	-	0.501	0.501	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.062	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Bobwhite quail	NOAEL	0.089	0.089	0.0002	0	-	0.089	0.089	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0012	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Marsh wren	NOAEL	0.122	0.122	0.001	0.0001	-	0.122	0.122	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0067	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Mallard duck	NOAEL	0.372	0.372	0.0005	0	-	0.372	0.372	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0029	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Scaup	NOAEL	0.111	0.019	0.0002	0	-	0.111	0.019	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0009	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Great blue heron	NOAEL	0.569	0.084	0.0004	0	-	0.569	0.084	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0025	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Bald eagle	NOAEL	0.455	0.056	0.0003	0	-	0.455	0.056	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.002	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.1
Mammalian	Deer mouse	NOAEL	0.159	0.159	0.0003	0	-	0.159	0.159	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0032	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Cottontail rabbit	NOAEL	0.126	0.121	0.0002	-	-	0.126	0.121	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	-	-	-	1
		LD50	-	-	-	0	-	-	-	0.0001	-	0	0.5
	Norway rat	NOAEL	0.057	0.057	0.0002	0	-	0.057	0.057	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0011	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Red fox	NOAEL	0.094	0.094	0.0002	0	-	0.094	0.094	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.001	-	-	1
		LD50	-	-	-	-	-	-	-	-	-	0	0.5
	Mule deer	NOAEL	0.060	0.058	0.0001	0	-	0.060	0.058	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0007	-	-	1

Table 14.2-3. Wildlife Hazard Quotients From Combined Ingestion Exposure Pathways

Class	Species	Tox. test	CFT Legumine®					Noxfish®					Level of Concern (LOC) ^g
			Rotenone (50ppb) ^a [High / Average]		Diethylene Glycol Monoethyl Ether ^b	1-Methyl-2-Pyrrolidinone ^c	Naphthalene (0.341ppb) ^d	Rotenone (50ppb) ^a [High / Average]		Naphthalene (68.326ppb) ^d	Toluene ^e	1,2,4 Trimethylbenzene ^f	
	Black bear	LD50	-	-	-	-	-	-	-	-	-	0	0.5
		NOAEL	0.049	0.013	0.0001	0	-	0.049	0.013	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0006	-	-	1
	Cow & calf	LD50	-	-	-	-	-	-	-	-	-	0	0.5
		NOAEL	0.056	0.053	0.0002	0	-	0.056	0.053	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0012	-	-	1
Reptilian	Pond turtle	LD50	-	-	-	-	-	-	-	-	-	0	0.5
		NOAEL	-	-	0	0	-	-	-	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0002	-	-	1
	Common garter snake	LD50	-	-	-	-	-	-	-	-	-	0	0.5
		NOAEL	-	-	0	0	-	-	-	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.0002	-	-	1
Amphibian	Pacific treefrog	LD50	-	-	-	-	-	-	-	-	-	0	0.5
		NOAEL	-	-	0.0012	0.0001	-	-	-	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.007	-	-	1
	Western toad	LD50	0.095	0.095	-	-	-	0.095	0.095	-	-	0	0.5
		NOAEL	-	-	0.0012	0.0001	-	-	-	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.007	-	-	1
	Long-toed salamander	LD50	0.094	0.094	-	-	-	0.094	0.094	-	-	0	0.5
		NOAEL	-	-	0.0012	0.0001	-	-	-	-	0	-	1
		LOAEL	-	-	-	-	0	-	-	0.007	-	-	1
		LD50	0.094	0.094	-	-	-	0.094	0.094	-	-	0	0.5

NOAEL: No observable adverse effect level.

LOAEL: Lowest observable adverse effect level.

LD₅₀: The concentration of chemical leading to a 50 percent mortality of the test animals within a given time period.**Footnotes on Toxicity Reference Values (TRVs):**^aThe rotenone NOAEL value for all mammal and bird species was 0.4mg/kg-bw/day. This value represents the lowest NOAEL value available for separate lab-based studies on rats and dogs (USEPA, 1988; U.S. Fish and Wildlife Service, 1980). The rotenone LD50 value for all amphibian species was 0.58mg/kg. This value represents the lowest LD50 value available for lab-based studies on adult and larval amphibians ().^bThe Diethylene Glycol Monoethyl Ether NOAEL value for all species was 490mg/kg-bw/day. This value represents the lowest NOAEL value available for lab-based studies on rats (see Table J-15)). No reports on studies using different animal classes were available.^cThe 1-Methyl-2-Pyrrolidinone NOAEL value for the Norway rat was 3000mg/kg-bw/day based on lab rats. The 1-Methyl-2-Pyrrolidinone NOAEL value for all other species was 1000mg/kg-bw/day. This value represents the lowest available NOAEL obtained from lab-based studies on mice (MSDS Number: B&J 0304, 2001).^dThe Naphthalene LOAEL value for all mammal and bird species was 10mg/kg-bw/day (NTP, 1992). This value represents the lowest TRV value available for lab-based studies on rats. Although a NOAEL value of 100mg/kg-bw/day was available from lab-based mice studies (NTP, 1980) this was only used for mice given that it was greater than the rat LOAEL.^eThe Toluene NOAEL value for all mammal and bird species was 312mg/kg-bw/day (NTP, 1990). This value represents the only TRV value available and refers to a lab-based rat study.^fThe 1,2,4 – Trimethylbenzene LD50 value for all mammal and bird species was 5000mg/kg-bw. This represents the acute 24 hour LD50 value for lab-based studies on rats.^gHazard quotients exceeding these levels of concern suggest possible toxicological risk and require further analysis to address potential injury.

constituents. Hazard quotients for fish, aquatic invertebrates and amphibians were calculated only for rotenone, as the effects of the active ingredient in the aquatic system so overwhelm the potential effects of the inert dispersant ingredients. As reflected in Tables 14.2-2 and 14.2-3, the ‘Level of Concern’ associated with the calculated HQ varies based on whether the estimated dose was compared against an LD₅₀ value or a NOAEL toxicity threshold value from the scientific literature.

As is demonstrated in Table 14.2-3, two HQ values are represented for many of the wildlife species examined. These values represent an estimate of an “average” or typical exposure, and a “reasonable maximum exposure” based on dose estimates where input parameters of bioaccumulation, site use, and percent bioavailability (of exposure dose) were adjusted, as described in Appendix J, Section J.4.2.1.

14.2.3 No Project/No Action

The No Project/No Action alternative has potentially significant adverse conditions associated with it, but none that are related to hazardous materials use. Specific elements of the No Project alternative are addressed in Section 2.2. Under No Project, the DFG would attempt to retain the pike in the reservoir with the use of containment structures that are currently under construction. For the most part, the fishery and reservoir operations would be managed as currently practiced.

The problems pike have caused at Lake Davis could occur in other areas of the state or region if pike escape or are moved and become established elsewhere. Pike are voracious predators that are likely to successfully invade other waters, including those of the Central Valley, should they escape from Lake Davis, which is likely unless they are eradicated (See Section 1.1.4). Since pike do not have a significant natural predator in these waters, the pike could have a significant adverse impact on other aquatic species in the area. In spite of some uncertainty in quantifying the impacts of pike on fishes in the Central Valley should they become established, it is likely the effects would be great. These waters support a number of species whose populations have already declined significantly, as well as many other species which are vulnerable to predation by pike (Appendix A, Maniscalco and Morrison 2006). Many of these species are likely to be adversely affected should pike become established in the waterways of Central Valley. These include chinook salmon, steelhead, delta smelt, and splittail, the populations of which are currently in peril, even without the presence of pike in the Delta (Moyle 2002).

There is no significant adverse impact to ecological or human health from hazardous materials and/or wastes under the No Project/No Action alternative because no hazardous materials would be transported to the project area or used in conjunction with this alternative, and no hazardous wastes would be generated.

14.2.4 Proposed Project/Proposed Action – 15,000 Acre-Feet (Plus Treatment)

The Proposed Project includes the addition of formulations of CFT Legumine[®] and/or Noxfish[®] to Lake Davis and tributaries to achieve a projected active ingredient concentration of 50 ppb, as well as the projected rotenone formulation constituent concentrations shown

previously in Table 14.1-1. Based on drawdown modeling, the Proposed Project reservoir level could be achieved by September 5, which would ensure warmer water temperatures and would minimize the potential for longer persistence of rotenone and rotenone constituents in aquatic sediments that could occur if the treatment were to occur later in the year.

14.2.4.1 Ecological Health

Toxicity Effects from Hazardous Materials on Non-target Fish

Although the intent is to eradicate northern pike, the use of rotenone formulations as a piscicide would also kill many non-target fish and aquatic-dependent species, based on a comparison of the species sensitivities to the treatment concentration (i.e., the hazard quotients that exceed “1” in Table 14.2-2, relative to the NOAEL). It is likely that some brown bullhead known to exist in the reservoir would survive the treatment, and perhaps some centrarchids such as pumpkinseed sunfish. Trout eggs that are in the gravel in the tributary streams, such as for fall spawning brown and brook trout, would also likely survive.

Impact HEH-1: Non-target fish species may be impacted adversely by rotenone formulation toxicity associated with the treatment with the use of either rotenone formulation proposed. The eradication of trout shall be rapidly addressed by careful restocking following treatment and neutralization, in accordance with procedures outlined in Section 2.3.7 under the Proposed Project. Because the restocking is part of the Proposed Project, the impacts to non-target fish species (e.g., trout) are considered less than significant.

Mitigation HEH-1: No mitigation is required.

Toxicity Effects from Hazardous Materials on Aquatic Invertebrates

Based on their sensitivity, as summarized in Table 14.2-2, many aquatic invertebrate taxa should survive the proposed chemical treatment, provided they are not desiccated in the littoral zone from dewatering. However, population levels would likely be affected in the short term. Monitoring of the littoral macroinvertebrate community following the 1997 treatment indicated that some sensitive species were significantly impacted for at least two years after treatment (DFG 2006).

Effects on limnetic zooplankton would also likely be significant, with lethality likely. However, after the 1997 treatment overall zooplankton abundance was roughly 300 percent of the pre-treatment abundance within one year after the treatment (DFG 2006d, see <http://www.dfg.ca.gov/northernpike/docs/1997AquaticInvertRpt.pdf>). Further, all zooplankton taxa recovered before treatment were identified after the population recovered following treatment. The return of zooplankton populations to levels above that measured before rotenone treatment is generally the response seen as a result of a lack of grazing by fish. Therefore, re-establishment of zooplankton after the proposed treatment is expected to occur rapidly, with full recovery anticipated within one year of a treatment, and significant recovery measurable within months.

It is also possible that other changes in invertebrate community composition could result from the selective loss of some invertebrate species allowing recolonization by other species not currently abundant in the reservoir. Such impacts could have long-range effects on ecosystem function in the reservoir, but are not possible to fully predict and remain a source of uncertainty.

As a reservoir, Lake Davis is an artificial ecosystem. The aquatic invertebrates present in the reservoir colonized from elsewhere historically and none have been identified as endemic or sensitive in California. Any aquatic invertebrate taxa that are extirpated by the treatment should be able to recolonize the reservoir after treatment using mechanisms similar to those that led to their original colonization. The streams and springs tributary to the reservoir are natural features, some of which may constitute unique habitats that may contain macroinvertebrate species of special status. Rotenone treatment is not anticipated to result in the loss of all exposed aquatic macroinvertebrate species that may be resident in the treatment area (including special status species); treatment concentrations would be below concentrations known to kill many species (see Appendix J, Table J-35). Recovery of populations particularly sensitive to rotenone would depend on the individual species' ability to re-colonize from nearby habitats.

Impact HEH-2: Non-target aquatic invertebrate species may be impacted adversely by rotenone formulation toxicity with the use of either rotenone formulation proposed. The Proposed Project would have a less than significant impact on special status macroinvertebrate species in the reservoir, because none are known or suspected to occur in Lake Davis. The impacts of the Proposed Project on special status invertebrate species in the tributary streams and springs would be significant but mitigable. The amphibious caddisfly, *D. bethula*, is known to occur in Big Grizzly, Old House and Cow creeks and would be affected by the treatment (see Table 7.1-2). Impacts to pelagic zooplankton communities would be less than significant because of their rapid recolonization. However, the time for littoral macroinvertebrate communities to fully re-establish may exceed two years, based on past monitoring. This impact is adverse, significant and unavoidable. Collectively, eradication and/or suppression of some aquatic invertebrate populations in the Lake Davis project area from rotenone toxicity is likely, and is a significant and unavoidable adverse impact, since some species may take more than two years to re-establish to pre-treatment levels.

Mitigation HEH-2: For significant but mitigable impacts explained above, see mitigation measures AR-10a, AR-10b, AR-10c, AR-10d, AR-10e, and AR-10f in Section 7.1.2.4. These measures would reduce these adverse impacts to less than significant. No feasible options are available to effectively re-seed invertebrate communities in the reservoir. Avoiding trout restocking for a period while the zooplankton population recovers would speed the recovery of this community. However, it is not expected to benefit the littoral community, as trout would feed preferentially on zooplankton, which would recover much more quickly than the littoral community. There are no reasonably prudent measures to prevent the loss of individual macroinvertebrate and zooplankton species that may be impacted.

Significance After Mitigation: Less than significant for special status invertebrate species; significant and unavoidable for littoral macroinvertebrate communities to fully re-establish.

Toxicity Effects from Hazardous Materials on Amphibians and Reptiles

Amphibians, particularly gilled larvae, if present, could be adversely impacted through uptake of rotenone from the water across their gills. This impact would be significant if gill breathing life stages are present in the reservoir and its tributary streams and springs at the time of treatment (i.e., mid-August to early October). Amphibian species of special status are the mountain yellow-legged frog and the foothill yellow-legged frog, neither of which has been found in the project area in recent surveys (see Section 7.2.1.4, Table 7.2-1). Other potentially affected species include Pacific treefrog, western toad and long-toed salamander. Based on an analysis of the treatment concentrations relative to species' sensitivity, the potential exists that amphibians could be significantly impacted by the Proposed Project through direct uptake. However, mortality of amphibians from the treatment is not considered likely, due to the time of year the treatment would occur, and the relative absence of gill breathing juveniles that would be anticipated to be in the reservoir and its tributary streams and springs at the time of treatment (see Section 7.2.2.4).

Evidence from risk assessment (Appendix J) does not suggest that snakes and other reptiles without specialized respiratory structures would be affected by the proposed treatment. Impacts from rotenone to turtle species in the family Kinosternidae that possess specialized respiratory structures has been documented (Fontenot et al. 1994), as detailed in Appendix J. However, no rotenone or rotenone formulation toxicity information related to this family or genus of turtle (Emydidae, *Clemmys* sp.) was identified in the literature, so the potential effects on the northwestern pond turtle remain uncertain.

Impact HEH-3: Non-target amphibian and obligate aquatic reptile species may be impacted adversely by rotenone formulation toxicity associated with the treatment, with the use of either rotenone formulation proposed. Given the uncertainty associated with the current understanding of amphibian and reptile use of the project area, and the life history stages that could be in the reservoir and tributary streams and springs at the time of treatment, it is conservatively concluded that the adverse impact is significant but mitigable.

Mitigation HEH-3: Mitigation should be in accordance with that outlined as terrestrial wildlife mitigation TW-1, as described in Section 7.2.2.4.

Significance After Mitigation: Less than significant.

Toxicity Effects from Hazardous Materials on Terrestrial and Avian Wildlife

In contrast to the potential impacts on fish, aquatic invertebrates, amphibians and reptiles, food web modeling in terrestrial and avian wildlife does not suggest that rotenone formulation exposure would cause a significant impact through ingestion. (Notably, ingestion modeling for amphibians and reptiles also did not indicate significant risk via that exposure pathway). None of the calculations of ingestion doses exceeded relevant toxicity thresholds, nor did any calculated hazard quotients (HQs) exceed the more conservative Levels of Concern identified in Table 14.2-3, as developed by the USEPA (2005). Similarly, exposure to the most concentrated rotenone formulation constituents (i.e., the 'inert' ingredients) does not appear to pose a risk to terrestrial or avifauna, using similar modeling methods, whether

CFT Legumine[®], or Noxfish[®] is selected as the rotenone product for use under the Proposed Project.

Inhalation exposure to volatilized rotenone formulation constituents does not appear to represent a significant toxicity impact to terrestrial and avian wildlife based on a comparison of projected air concentrations to acute threshold effects identified in animal models. Chronic exposures are not relevant to the air pathway for exposure for any ecological receptor.

Impact HEH-4: No toxicity to avian and terrestrial wildlife and cattle from rotenone formulation constituents is likely from ingestion, based on conservative food web modeling, or from inhalation, based on comparison of screening modeled air concentrations to inhalation effects thresholds.

Mitigation HEH-4: No mitigation is required.

Effects from Dead Fish

Most of the dead fish resultant from treatment would be removed as part of the Proposed Project (and all pike eradication alternatives). A limited number of dead fish may be available to wildlife scavengers. Such scavengers regularly consume dead fish and other animal carcasses as part of their diet. Decomposing fish may contain an assemblage of potentially harmful bacteria such as *Salmonella* sp., *Botulinum* sp., and *E. coli*. (Claeson et al. 2006). This risk would be managed by the implementation of the dead fish recovery and removal operation (see Section 2.3.6). Dead fish would represent a source of food typical to scavenging wildlife in the Lake Davis project area. No evidence of bacterial disease in wildlife resultant from rotenone treatment was identified in the literature describing and/or reviewing a substantial number of field applications of the piscicide (Appendix J). Further, most dead fish that are not captured would sink to the bottom and be unavailable for consumption.

Bacterial contamination of the reservoir water, a source of drinking water for wildlife, is not anticipated, as bacteria associated with decomposition are primarily substrate-associated, and should not be present in the water column at high levels. Wildlife would also have numerous readily available alternatives to drinking water in the reservoir. Finally, drawdown conditions would likely inhibit the desire of wildlife to drink from the reservoir given the high degree of visual exposure that would be required to do so.

Impact HEH-5: Non-aquatic wildlife would not likely be adversely impacted by bacterial contamination from dead fish. This impact is therefore considered less than significant under the Proposed Project.

Mitigation HEH-5: No further mitigation is required beyond the rapid removal of dead fish following treatment.

14.2.4.2 Human Health and Safety

Following the 1997 treatment of Lake Davis with Nusyn-Noxfish[®], extensive water and air quality monitoring was conducted by the DFG and PCEH in the reservoir and in Big Grizzly Creek. Rotenone, rotenolone, volatile organic compounds (VOCs), semi-volatile organic compounds, and piperonyl butoxide (PBO) were analyzed by these agencies in surface and

groundwater, sediment, and air. Results of these monitoring efforts are thoroughly addressed in Sections 3, 4, and 5, and collectively, in Appendix J. They are briefly summarized here only to support impact conclusions relevant to specific environmental concerns associated with human health and safety. Results of PBO detections are not discussed, as this synergist compound is not in any proposed rotenone formulation for the Proposed Project. Fate and transport of additional constituents in CFT Legumine[®] not present in Noxfish[®] (hence monitored previously) are considered, where data allowed, for their potential to elicit human health and safety impacts.

Toxicity Effects from Surface Water Exposure

Past studies, summarized by Finlayson et al. (2001), demonstrated that rotenone and the carrier constituents present in the Noxfish[®] formulation under consideration should dissipate from surface water rapidly. Results from the October 1997 treatment at Lake Davis indicate that both rotenone and rotenolone declined to below the detection limits (2 µg/L) in surface waters 48 days following application (Siepmann & Finlayson 1999). Comparatively, the results demonstrated that most of the inert compounds dissipated before rotenone. Within a week of the treatment, VOC residues were completely absent from the samples, while the semi-VOCs persisted for no longer than two weeks. The only compound that remained in Lake Davis surface water long after the dissipation of rotenone, a total of thirty-nine weeks post-treatment, was piperonyl butoxide (PBO), which is not present in the formulations currently under consideration. Despite the relative non-persistence of the compounds in surface waters, these results suggested that modeling human exposure to surface water was prudent.

Although the forest closures identified as part of the Proposed Project would legally prohibit exposure via swimming in the reservoir (making contact exposure extremely unlikely), this contact pathway was nonetheless modeled for human health risk assessment for the: (1) child camper, and (2) unauthorized youth populations (Appendix J). These groups were assumed to be the most likely to intentionally or unintentionally violate the forest closure specifications, and they are also the most sensitive—if such violations were to occur. The maximum surface water concentrations to which these two receptor groups could be exposed were based on full mixing of the formulations to a 1 mg/L solution—the desired treatment concentration (Table 14.1-1). The child camper and unauthorized youth receptors were assumed to swim in the treated water for three hours, and swallow a small amount of the surface water while swimming. USEPA standard exposure assumptions for swimming were used in this evaluation.

If contact with surface water during water sports were to occur during the application process in areas where formulation could be concentrated *before* complete mixing, then this exposure has the potential to result in toxic impacts for some sensitive individuals. However, recreational activities and visitor traffic into the project area would be restricted by the public health and safety forest closure that would be enforced during treatment and by post treatment monitoring that would require that no rotenone or formulation constituents are detectable before recreational activities are allowed to resume in the reservoir. Regardless of these safety factors, no exceedances of the health protective screening levels (HBSLs) were seen related to contact with the maximum surface water concentrations that could be

expected from either formulation under consideration for the Proposed Project—for either human receptor population considered the most vulnerable and sensitive to exposure (see Appendix J, Table J-56).

It is recognized that Lake Davis is designated as a drinking water supply for the City of Portola. The use of Noxfish[®], if selected, would result in an exceedance of the DHS drinking water action level for naphthalene of 170 ppb, a guidance level not promulgated in the California Toxics Rule, but recognized by the California Regional Water Quality Board as a water quality limit for components of petroleum-based fuels. (Other rotenone formulation constituents for which similar DHS drinking water action limits have been defined include xylene, 1,2,4 trimethylbenzene, 1,3,5-trimethylbenzene, n-butylbenzene, n-butylbenzene, and methylnaphthalene, but none of the estimated maximum concentrations of these constituents exceed the DHS action levels). However, Lake Davis is not currently used for a drinking water supply, and the treatment plant for this purpose is under construction. If a chemical treatment method is selected for pike eradication, it is possible that the treatment plant could be functionally operational and ready to receive water before all piscicide constituents have fully dissipated. The current estimate is that the water treatment plant would not be on-line before April 2008 which is approximately five months after the anticipated application of rotenone to Lake Davis if a project is approved and implemented. This potential exposure pathway will be eliminated by the risk management that is implicit to the project, which recognizes that a “zero residue” standard will be applied to the Lake Davis drinking water supply before it could be used as drinking water. That is, post treatment monitoring must repeatedly confirm the lack of detection of all rotenone formulation constituents before the treatment plant is activated to deliver water to the general public.

The potential for adverse human health impacts to the general public from surface water ingestion via the Lake Davis drinking water supply is addressed by post treatment monitoring. This component of the project description will ensure that no treatment chemical residues are detectable before Lake Davis water is delivered to the general public, and no impact is concluded.

Impact HEH-6: Past monitoring, conceptual exposure modeling, and environmental fate analysis, suggests exposure to rotenone formulation constituents through surface water is possible, albeit unlikely, for some youth sectors of the public. The potential for adverse human health impacts by youth from surface water exposure is considered less than significant based on risk assessment.

Mitigation HEH-6: No further mitigation beyond the surface water monitoring and forest closures already specified as part of the Proposed Project is required.

Toxicity Effects from Sediment Exposure

In a report summarizing monitoring results from eight projects where Nusyn-Noxfish[®] was applied, rotenone, rotenolone and some semi-VOC (naphthalene and methylnaphthalene) were detected above the analytical detection limits in sediments for varying periods of time after treatment (Finlayson et al 2001). Detection limits were 30 micrograms/kg-dry wt for rotenone and rotenolone, and 6 µg/kg for the volatile and semivolatile organic compounds. In standing water sediments from these study sites rotenone and rotenolone were detected for a

maximum of 60 days, with maximum concentrations of 522 and 890 µg/kg-dry weight, respectively. No VOCs (e.g., xylene, TCE) were ever detected, in either flowing or static water sediments. The only semi-VOCs detected in reservoir sediments were naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. Detectable concentrations of these semi-VOCs were measured up to 180 days after treatment in standing water sediments, with maximum concentrations of 91 and 231 µg/kg for naphthalene and methylnaphthalene, respectively.

Past monitoring of sediment quality following the 1997 Lake Davis treatment (Siepmann and Finlayson 1999) is generally reflective of the broader results discussed above. Specifically:

- The measured levels of rotenone and rotenolone in reservoir bottom sediments had dropped below detection limits 55 days after treatment;
- No VOCs were detected in sediment samples; and
- Semi-VOCs (naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene) were detected in sediment samples, but measured levels of these compounds dropped below detection limits 55 days after treatment.

Based on the above summarized findings, and reflected in Figure 14.11, sediment contamination from the application of rotenone formulation chemicals was considered as a potential environmental exposure pathway to the ‘unauthorized youth’ and ‘youth camper’ human receptor populations—consistent with the rationale applied to the surface water exposure analysis. In the supportive risk assessment to this Section, no exceedances of the site-specific health based screening levels (HBSLs) for sediment (see Appendix J, Table J-58) were identified when comparing the maximum sediment concentrations of formulation constituents detected following the 1997 treatment. Some compounds in the CFT Legumine[®] formulation are not present in the Noxfish[®], however, so past monitoring does not provide information from which to gauge potential exposure. These principal constituents include diethylene glycol monoethyl ether, and methyl-2 pyrrolidinone. Both of these compounds are considered “infinitely soluble in water” and would therefore not be expected to adsorb to sediments and provide a potential longer term source of chemical exposure (see Appendix J, Table J-15).

Impact HEH-7: Past monitoring, conceptual exposure modeling, and environmental fate analysis, suggest sediment exposure to rotenone formulation constituents is possible, albeit unlikely, for some youth sectors of the public. The potential for adverse human health impacts by youth from sediment exposure is considered less than significant based on risk assessment.

Mitigation HEH-7: The forest closure during and after treatment that is part of the Proposed Project would limit the potential for exposure. Monitoring results would be used to gauge when rotenone treatment chemicals are no longer detectable. No further mitigation is required.

Toxicity Effects from Drinking Water Exposure via Groundwater Wells

Evidence is lacking to suggest that any treatment compounds introduced into Lake Davis in 1997 migrated into the surrounding groundwater, nor that groundwater contamination could

be expected from the rotenone formulation and neutralization constituents currently under consideration for use. Post treatment groundwater monitoring by the DFG in 26 wells from nine areas where Nusyn-Noxfish[®] had been applied, including 5 wells in the 1997 Lake Davis treatment area, failed to identify groundwater contamination with VOC and SVOCs in wells monitored up to 456 days following treatment—with the exception of a single xylene detection in a Corps of Engineers well 59 days after treatment of the Kaweah Reservoir (Finlayson et al. 2001). This detection was considered an anomaly, and xylene was not detected at the subsequent sampling, 185 days after treatment. Notably, all of the five wells monitored by the DFG in the Lake Davis project area after the 1997 treatment were located immediately adjacent to the reservoir, and four were at the southern end, downgradient of the reservoir's outlet. It is reasonable to assume the groundwater quality in these shallow wells, as close as 450 feet from the treated surface waters in the reservoir with a depth range of 26 to 73 feet, would have been affected if surface water (containing rotenone formulation constituents) migrated into groundwater towards these wells. However, the negative monitoring data do not support this scenario (Finlayson et al. 2001).

Below the dam, groundwater levels in the Big Grizzly Creek ravine are lower than reservoir levels. Therefore, the potential exists for groundwater to flow from the reservoir into Big Grizzly Creek through sediments and fractured bedrock (Gardner 1999), and there is some potential for springs in that area to recharge with Lake Davis water. However, the Big Grizzly Creek Canyon is a groundwater discharge area (see Section 4.1.1.2); thus, it is highly unlikely that any chemical treatment compounds in the water that would flow down the creek after being released from Lake Davis would enter the groundwater aquifers adjacent to the creek (Gardner 1999).

One well, the Grizzly Lake Resort Improvement District (GLRID) well is located approximately 5,000 feet downstream from Lake Davis in the Big Grizzly Creek Canyon. Based on data collected by the DWR, this well is cycled on and off on approximately a one week basis. The water is pumped to a holding tank and run through carbon filtration prior to distribution. The well is allowed to equilibrate prior to the next pumping cycle (see Figure 4-2). May-July 2006 data from GLRID well indicate pumping levels range from about 5,450 feet to about 5,370 feet. The estimated elevation of Big Grizzly Creek in this vicinity is about 5,420. Long-term monitoring of the groundwater level and pumping activity in the GLRID well by DWR will provide information regarding how this well may be influenced by Big Grizzly Creek. But, because this area is a groundwater discharge area, it is highly unlikely that any chemical treatment compounds in the water that would flow down the creek after being released from Lake Davis would enter the groundwater aquifers adjacent to the creek (Gardner 1999). Further, data indicates that the water in the GLRID comes from snowpack or precipitation, rather than a surface water sources (see Section 4.1.1.2 Lawrence Livermore Groundwater Age Dating).

The lack of detections seen in the DFG groundwater well data are also consistent with the ongoing 10-year monitoring program being conducted by Plumas County Environmental Health (PCEH), where 81 wells in the Lake Davis project area have been monitored for potential contamination following the 1997 treatment. This program was developed by Plumas County in response to public concern. In the PCEH monitoring to date, over 1,224 samples have been collected over a 7-year period. There was one verified detection--(a

verified detection is consistent detection of a compound in the same well of a compound that was also found in the rotenone formulation used in 1997. Specifically Toluene, found in the Nusyn-Noxfish[®] undiluted solution used to treat the reservoir in 1997, but never detected in the reservoir itself, was detected in one well. The toluene detection was likely due to a documented pump replacement at the well.

In addition, there were two unverified detections of compounds also found in the rotenone formulation used in 1997.

There was an inconsistent and unverified detection of trichloroethylene at one well not attributable to the rotenone treatment. The concentrations detected, well location, and inconsistent detections do not suggest any connection with the 1997 rotenone treatment of the reservoir. There was an unverified detection of naphthalene at one well that has not been repeated. The location and timing of this detection does not suggest that it is connected with the treatment. It is concluded that the detection of these solvents, common to pump apparatus and fuels, is likely not attributable to the 1997 reservoir treatment, given the well locations and the transient nature of detections (usually one detection event only per well)(Maureen Ridley, personal communication, 2006).

In summary, as fully detailed in Section 4 and Appendix J, groundwater was not considered a complete human exposure pathway for hazardous materials exposure (via the surrounding campground and downgradient community wells) because: (1) groundwater discharges into Lake Davis from the surrounding higher elevations of the basin, (2) City of Portola wells downgradient of Lake Davis tap into a deeper aquifer that is distinct from the reservoir, (3) private wells downgradient of Lake Davis principally recharge from the east and west of the Big Grizzly Creek watershed, not from the reservoir (past groundwater level monitoring by DWR has not shown connectivity to reservoir levels), (4) in general groundwater in the Big Grizzly Creek watershed discharges to the creek (therefore chemicals potentially present in the creek would not be expected to move laterally away from the creek towards private wells), (5) the nearest private wells are over 1,000 feet from Lake Davis, which would require an extensive migration for the rotenone formulation constituents, whose physical and chemical properties indicate rapid degradation is likely (see Appendix J, Table J-15), and (6) wells in close proximity to the creek that have the potential to draw creek water would not have detectable levels of treatment and neutralization chemicals due to rapid degradation and sediment adsorption.

Impact HEH-8: Past monitoring, environmental fate analysis, and conceptual exposure modeling do not indicate complete exposure to rotenone formulation and neutralization constituents is likely through drinking water obtained from groundwater wells.

Therefore, this pathway for exposure was considered incomplete in risk assessment (Appendix J). The hazardous materials adverse impacts to human health from groundwater exposure and/or toxicity are considered less than significant.

Mitigation HEH-8: No mitigation is required. Post-treatment groundwater monitoring would occur.

Toxicity Effects from Inhalation Exposure

The Proposed Project identifies the possible application of CFT Legumine[®] and/or Noxfish[®] formulations. When water concentrations are those shown previously on Table 14.1-1 above, then air concentrations (estimated) as shown in Table 14.2-4 have been predicted to occur using the Screen3 modeling. As shown on this table, the Noxfish[®] formulation results in an air concentration for naphthalene 500 m away from the treatment area that is above the Health Based Screening Level (HBSL) values at both 1 and 24 hours post treatment, for all the human receptor populations evaluated (i.e., nearby residents, nearby workers, child campers, and unauthorized youth (e.g., interlopers). HBSLs are calculated health protective concentrations of chemicals in surface water, sediment, and air derived according to regulatory guidelines for specific potential exposure scenarios as described in detail in Appendix J. HBSLs were developed for each piscicide formulation component for each exposure medium (i.e., surface water, sediment or air) and corresponds to an acceptable risk level (i.e., 1×10^{-6} for individual carcinogens and a target hazard index of 1 for individual noncarcinogens). Modeled trimethylbenzene concentrations also exceed the HBSL for the 1-hr exposure to *nearby resident populations* (only). In contrast, the CFT Legumine[®] formulation, when compared to the HBSL values, did not exceed the HBSLs, indicating there is no significant impact for inhalation risks under this alternative if using this product. As shown below the modeled concentrations of CFT Legumine[®] constituents are 5 to over a 1,000,000 times lower than the HBSLs.

Table 14.2-4. Comparison of Piscicide Component Concentrations in Ambient Air to Health-Based Screening Levels and Odor Threshold Concentrations Under Proposed Project

Components	Modeled Concentration in Ambient Air at 500 meters (mg/m³)		Health-Based Screening Levels (HBSL) for Vapors in Ambient Air (mg/m³)				Odor Threshold (mg/m³)
	1-Hour Maximum	24-Hour Average	Nearby Resident	Nearby Worker	Child Camper	Unauthorized Youth	
CFT Legumine®							
Rotenone	5.49E-03	1.65E-03	7.30E-02	1.70E-01	3.15E-01	4.17E-01	na
Butylbenzene, 1-	3.08E-05	9.23E-06	2.01E+00	4.68E+00	8.65E+00	1.15E+01	na
Butylbenzene, sec-	6.31E-04	1.89E-04	2.01E+00	4.68E+00	8.65E+00	1.15E+01	na
Isopropyltoluene, 4-	2.98E-05	8.95E-06	2.56E+01	5.96E+01	1.10E+02	1.46E+02	na
Methylnaphthalene, 2-	7.83E-04	2.35E-04	7.30E-02	1.70E-01	3.15E-01	4.17E-01	na
Naphthalene	1.96E-03	5.88E-04	1.06E-02	2.48E-02	4.59E-02	6.08E-02	4.40E-01
Trimethylbenzene, 1,3,5-	3.82E-05	1.14E-05	3.10E-01	7.24E-01	1.34E+00	1.77E+00	na
Diethylene glycol monoethyl ether	na	na	1.57E-01	3.66E-01	6.76E-01	8.97E-01	1.12E+00
Methyl-2-pyrrolidinone, 1-	5.72E-02	1.72E-02	7.85E-01	1.83E+00	3.38E+00	4.48E+00	na
Rotenolone	6.74E-04	2.02E-04	nd	nd	nd	nd	na

Table 14.2-4. Comparison of Piscicide Component Concentrations in Ambient Air to Health-Based Screening Levels and Odor Threshold Concentrations Under Proposed Project

Components	Modeled Concentration in Ambient Air at 500 meters (mg/m³)		Health-Based Screening Levels (HBSL) for Vapors in Ambient Air (mg/m³)				Odor Threshold (mg/m³)
	1-Hour Maximum	24-Hour Average	Nearby Resident	Nearby Worker	Child Camper	Unauthorized Youth	
NoxFish®							
Rotenone	6.36E-03	1.91E-03	7.30E-02	1.70E-01	3.15E-01	4.17E-01	na
Butylbenzene, 1-	7.10E-02	2.13E-02	2.01E+00	4.68E+00	8.65E+00	1.15E+01	na
Isopropylbenzene	5.42E-04	1.63E-04	2.01E+01	4.68E+01	8.65E+01	1.15E+02	
Isopropyltoluene, 4-	7.88E-03	2.37E-03	2.56E+01	5.96E+01	1.10E+02	1.46E+02	na
Naphthalene	3.92E-01	1.18E-01	1.06E-02	2.48E-02	4.59E-02	6.08E-02	4.40E-01
Propylbenzene, 1-	1.97E-03	5.91E-04	2.01E+00	4.68E+00	8.65E+00	1.15E+01	na
Toluene	1.81E-02	5.43E-03	2.56E+01	5.96E+01	1.10E+02	1.46E+02	8.07E+00
Trichloroethene	7.71E-04	2.31E-04	1.83E-01	4.26E-01	7.86E-01	1.04E+00	2.69E+02
Trimethylbenzene, 1,2,4-	9.54E-02	2.86E-02	9.31E-02	2.17E-01	4.01E-01	5.32E-01	na
Trimethylbenzene, 1,3,5-	8.20E-03	2.46E-03	3.10E-01	7.24E-01	1.34E+00	1.77E+00	na
Xylene, 1,2-	4.93E-04	1.48E-04	1.57E+00	3.66E+00	6.76E+00	8.97E+00	4.43E-01
Xylene, 1,3- and/or 1,4-	3.96E-03	1.19E-03	1.57E+00	3.66E+00	6.76E+00	8.97E+00	4.43E-01
Rotenolone	na	na	nd	nd	nd	nd	na

na = not available; nd = not determined.

Conc = modeled air concentration exceeds one or more calculated HBSLs.

Conc = 1-hour maximum concentration exceeds this HBSL.

Conc = 1-hour maximum and 24-hour average concentrations exceed this HBSL.

Table 14.2-5 below summarizes the Noxfish[®] air exceedances for naphthalene and trimethylbenzene for all the project alternatives and various distances from the treated reservoir surface. There were no such exceedances for the CFT Legumine[®] for any of the alternatives at any of the modeled distances. Due to the low volume of rotenone formulations proposed for use under Alternative B, air modeling was not used for risk assessment purposes.

Table 14.2-5. Modeled Air Concentrations for Noxfish® That Exceed Inhalation HBSLs and/or Odor Thresholds

Component/ Distance from Source	Proposed Project		Alternative B		Alternative C		Alternative D	
	1-Hour Maximum	24-Hour Average	1-Hour Maximum	24-Hour Average	1-Hour Maximum	24-Hour Average	1-Hour Maximum	24-Hour Average
Naphthalene								
1 m	0.30 C,R,U,W	0.091 C,R,U,W	0.17 C,R,U,W	0.052 C,R,W	0.46 C,R,U,W,O	0.14 C,R,U,W	0.52 C,R,U,W,O	0.16 C,R,U,W
100 m	0.31 C,R,U,W	0.094 C,R,U,W	0.20 C,R,U,W	0.059 C,R,W	0.48 C,R,U,W,O	0.14 C,R,U,W	0.55 C,R,U,W,O	0.16 C,R,U,W
500 m	0.39 C,R,U,W	0.12 C,R,U,W	0.20 C,R,U,W	0.060 C,R,W	0.56 C,R,U,W,O	0.17 C,R,U,W	0.64 C,R,U,W,O	0.19 C,R,U,W
1,000 m	0.26 C,R,U,W	0.078 C,R,U,W	0.11 C,R,U,W	0.032 R,W	0.63 C,R,U,W,O	0.19 C,R,U,W	0.72 C,R,U,W,O	0.22 C,R,U,W
2,000 m	0.15 C,R,U,W	0.046 C,R,W	0.12 C,R,U,W	0.037 R,W	0.30 C,R,U,W	0.089 C,R,U,W	0.34 C,R,U,W	0.10 C,R,U,W
5,000 m	0.094 C,R,U,W	0.028 R,W	0.043 R,W	0.013 R	0.18 C,R,U,W	0.054 C,R,W	0.20 C,R,U,W	0.061 C,R,U,W
10,000 m	0.070 C,R,U,W	0.021 R	0.032 R,W	-	0.13 C,R,U,W	0.040 R,W	0.15 C,R,U,W	0.045 R,W
1,2,4-Trimethylbenzene								
1 m	-	-	-	-	0.11 R	-	0.13 R	-
100 m	-	-	-	-	0.12 R	-	0.13 R	-
500 m	0.095 R	-	-	-	0.14 R	-	0.16 R	-
1,000 m	-	-	-	-	0.15 R	-	0.18 R	-
2,000 m	-	-	-	-	-	-	-	-
5,000 m	-	-	-	-	-	-	-	-
10,000 m	-	-	-	-	-	-	-	-

Receptor Population	Screening Level HBSL	
	Naphthalene	1,2,4-Trimethylbenzene
C = child camper HBSL	0.046	0.40
R = nearby resident HBSL	0.011	0.093
U = unauthorized youth HBSL	0.061	0.53
W = nearby worker HBSL	0.025	0.22
O = odor threshold	0.44	not available

All units are mg/m³.**Bold value** is maximum modeled concentration for the alternative.

Based on a comparison of the Screen3 air modeling results to the HBSLs outlined in Tables 14.2-4 and 14.2-5, it appears that the Proposed Project could lead to potential adverse health impacts from the subchronic inhalation of naphthalene in the resident, unauthorized youth, child camper, and nearby worker human receptor populations modeled for risk assessment. However, these potential impacts were identified only with the Noxfish® rotenone formulation. Health impacts from trimethylbenzene may also be experienced by the 'nearby resident' population group with Noxfish®. In interpreting these results, it should be

noted that the Screen3 air concentration estimates are designed to be conservative and likely overestimate the actual air concentrations that may occur due to the Proposed Project (see discussion in Section 14.2.2 above). Exceedances of the HBSLs for naphthalene may be possible under the Proposed Project up to 10,000 meters from the project area (see Table 14.2-5) if Noxfish[®] is used as the rotenone formulation. However, these screening level estimates of air exposure likely overestimate the potential for adverse health impacts because of the conservative nature of the Screen3 air quality dispersion model that was used, and because the risk assessment paradigm used presumes a constant sub-chronic exposure over 30 days. Such an exposure paradigm is highly unlikely for volatile compounds that decline rather rapidly in concentration over time. Nevertheless, to be health protective in accordance with regulatory guidance for human health risk assessment (see Appendix J), and to comply with the significance criteria requiring a determination of significance if screening criteria are exceeded (14.2.1.1), these adverse impacts to human health are considered significant, but mitigable.

Impact HEH-9: Based on the conservative Screen3 air quality model, significant but mitigable adverse human health impacts may be experienced by some sectors of the public from the inhalation of rotenone formulation constituents volatilized into air after dilution in the reservoir.

Mitigation HEH-9: Use of the Noxfish[®] formulation would be balanced/combined with CFT Legumine[®] use that allows adequate rotenone concentrations in the water for the desired piscicide effect, but does not result in air concentrations for volatile solvent components above the health based screening levels (HBSLs) protective of human health.

Significance After Mitigation: Less than significant.

Impacts from Odor

Based on Screen3 air modeling, odor thresholds of formulation constituents are not exceeded under the Proposed Project for any of the constituents in Noxfish[®] or CFT Legumine[®].

Estimating the concentration of the principally offensive odorant from dead (rotting) fish, trimethylamine oxide, could not be done, as the ratio of dead fish removed to those inadvertently left behind cannot be ascertained from the project description and no environmental data from other studies were identified that allowed for a reasonable projection of odorant release based on an assumed number of dead fish. However, 100 tons of fish are estimated to be removed under the fish removal and disposal plan (2.3.5). Removal of the dead fish would largely eliminate the potential for noxious odor. Any odors remaining from dead fish that may be overlooked in the retrieval process are assumed to be extremely localized, within the project footprint contained by the forest closure. Thus, restricting public access to exposure areas where residual odor has the potential to persist for a short time would avoid this impact.

Impact HEH-10: Adverse impacts to humans from odor are considered less than significant for the Proposed Project.

Mitigation HEH-10: No further mitigation beyond the removal of dead fish already specified is required.

14.2.4.3 Neutralization Impacts on Human and Ecological Health

To prevent the release of rotenone from Lake Davis into Big Grizzly Creek prior to natural degradation of the chemical, four different neutralization options are under consideration. Neutralization options are described in detail in Appendix E and summarized in Section 2.7.4. The analysis provided here (in the Proposed Project impact section) should be considered consistent for all alternatives that would involve the use of rotenone for pike eradication. The following section considers the impacts from these options relative to the hazardous materials criteria presented earlier. Each option is under consideration for all project alternatives that involve the use of rotenone. Neutralization as described (under each option) was evaluated for its potential to impact human and/or ecological health through contamination of air, surface, sediment, and/or groundwater quality.

Option 1: Pumpback to Reservoir—No Chemical Neutralization

All outflow from Lake Davis would be eliminated and dam seepage would be returned to the reservoir by pumps and pipes or tanker trucks. This option eliminates the risk of rotenone or potassium permanganate entering Big Grizzly Creek. All flow in a stretch of 150 yards directly below the dam would cease. Flow beyond the dry stretch would be provided by spring water entering Big Grizzly Creek at about 60 gallons per minute. Rotenone would be naturally neutralized within Lake Davis prior to introduction back into Big Grizzly Creek. Post treatment monitoring would be conducted to ensure this outcome.

Rotenone would be fully neutralized through natural attenuation in Lake Davis. Natural attenuation would be confirmed through post treatment monitoring by the DFG and PCEH to confirm that residual levels of rotenone formulation constituents are below relevant health-protective regulatory criteria (e.g., MCLs), ecologically based TRVs, or levels of detection (i.e., where no regulatory criteria exist as applicable for some rotenone formulation constituents). No evidence exists from past treatment and monitoring to suggest that pumping rotenone back into the reservoir poses any more risk to human or ecological health than is already addressed under the Proposed Project. Drinking water wells would not be at risk of contamination from this option (see Section 4.2.4.5). Potential ecological risks from an imbalance of permanganate and rotenone concentrations that are possible with instream neutralization are avoided with this option.

HEH-11: Neutralization Option 1 poses no impact to human or ecological health.

Mitigation HEH-11: No mitigation is required.

Option 2: Offstream Neutralization of Minimal Flows

Flow from the dam would be curtailed for five days as the rotenone is mixed in Lake Davis. Potassium permanganate would be mixed with reservoir water in a neutralization station above the dam would use a system of pumps and containers and possibly a secondary filter system. The resultant solution of potassium permanganate-treated water and neutralized rotenone would be passed through granular activated carbon (GAC) or another substance to remove residual rotenone formulation constituents then piped over the dam to the creek. Flows would be reduced to 0.2 to 2.0 cfs for 14 to 45 days in Big Grizzly Creek below the dam. The potential exists for equipment failure that could pose a toxic risk to ecological

receptors in the creek. However, monitoring of the return flows to the creek would enable rapid resolution of potential equipment problems that could threaten ecological health.

Impact HEH-11: Neutralization Option 2 poses no impact to human and ecological health.

Mitigation HEH-11: No mitigation is required.

Option 3: Flow Releases of 1 to 2 cfs with Instream Treatment with KMnO_4

Flow from the dam would be curtailed for five days to allow the rotenone to mix. Subsequently, 1 to 2 cfs would be released from the dam and treated in-stream with potassium permanganate. If correctly balanced to rotenone concentrations and organic loads in the stream, such instream neutralization poses essentially no risk to human or ecological health. Rotenone is rapidly neutralized and permanganate is subsequently reduced. Neither will persist. However, like Option 2 (and 4 below) this option presents opportunities for human and equipment error that are difficult to fully predict, despite the fact that continuous monitoring would be provided. In the event of such error, significant impacts could occur. Thus, the option calls for the placement of “sentinel” fish cages downstream of the neutralization point (see Section 2.3.4) to provide an inherent mitigation measure allowing for adaptive management in the event of human or equipment error.

Impact HEH-12: Neutralization Option 3 poses a less than significant impact to human and ecological and health.

Mitigation HEH-12: No additional mitigation is required beyond curtailing flow from the dam as already specified.

Option 4: Flow Releases of 3 to 5 cfs with Instream Treatment with KMnO_4

Flow from the dam would be reduced to leakage for a five-day period while rotenone is mixed in the reservoir. Water would be released from the dam at 3 to 5 cfs and neutralized in-stream with potassium permanganate as described in Option 3. The increased flow projected under this option requires a greater amount of permanganate, and results in a smaller margin of safety in the event that permanganate concentrations are not balanced appropriately with rotenone concentrations at any time during the neutralization period.

Impact HEH-12: Neutralization Option 4 poses a less than significant impact to human and ecological health.

Mitigation HEH-12: No mitigation is required.

14.2.5 Alternative A – 15,000 Acre-feet (Plus Treatment Including Powder)

Alternative A is consistent with the Proposed Project with respect to reservoir drawdown, but replaces the use of a liquid rotenone formulation with the cube root powdered rotenone for reservoir treatment (only). Liquid formulations would continue to be used for tributary treatment, consistent with the Proposed Project. The use of powdered rotenone would involve the mixing of large quantities of powdered formula in a slurry mixture with water at staging areas and injecting the mixture into the reservoir. While the mixing is being conducted, all

staff in the vicinity would be required to wear personal protective equipment (PPE). Personnel will follow label directions relating to safety issues and PPE. If needed, rotenone powder (Fish Toxicant Powder) could also be combined with sand and gelatin to form gel balls to treat large pools, seeps, and springs. These gelatin balls would be produced off site and according to label direction and transported to the site for application. The use of PPE is adequate mitigation to minimize the risk of inhalation exposure to humans from fugitive powdered rotenone dust that could be liberated during the mixing process.

14.2.6 Ecological Health

Potential ecological health impacts under Alternative A would be consistent with those identified under the Proposed Project for the active ingredient rotenone (Impacts HEH-1, 2, 3, 4 and 5). Thus, non-target aquatic species (fish, amphibian, invertebrate) species would likely be adversely impacted by rotenone formulation toxicity associated with the treatment with the use of the rotenone powder and rotenone formulations proposed (Impacts HEH-1, 2 and 3). Dietary exposure risks to rotenone and/or dead fish are considered to be “no impact” (HEH-4) or “less than significant” for wildlife (Impact HEH-5). The eradication of desirable fish species (trout) would be consistent with the Proposed Project, as would elements to reduce this impact (restocking). As powdered rotenone would predominantly displace liquid formulation use, essentially no dispersant ingredients would be liberated, and therefore any risks associated with the uncertainty of effects attributed to these ingredients are reduced.

Effects of Fugitive Rotenone Dust on Wildlife

Inhalation toxicity from the use of liquid rotenone formulations in the streams is insignificant due to the low volume of solutions that would be applied. Inhalation toxicity to wildlife from fugitive rotenone dust from the use of rotenone powder in the reservoir represents a source of uncertainty because it was not possible to estimate the amount of dust that could be liberated during the process of slurry preparation and solution dispersion in the reservoir. However, on a strict ‘hazard classification’ basis, technical grade rotenone, the powdered cube root form considered for Alternative A, is a ‘highly toxic’ respiratory toxicant to mammals (EPA 2006). This classification simply means that it takes but a small amount to elicit an effect (see Appendix J, Table J-11, for range of toxicity classifications). Without rigorous site safety to specify the manner by which mixing and distribution of powdered rotenone would occur, significant hazards to nearby wildlife may exist.

Impact HEH-13: Fugitive rotenone dust generated during slurry preparation and reservoir treatment represents an unestimable potential risk to non-aquatic wildlife that is considered significant, adverse, and mitigable.

Mitigation HEH-13: Rotenone solutions created from the powdered cube root would be mixed mechanically, with a cover overlying the stock solution to prevent significant concentrations of fugitive rotenone dust from liberating into the air prior to dispersal into the reservoir. Use of powdered rotenone would be avoided if wind conditions on projected day(s) for treatment present uncontrollable fugitive dust conditions. These wind conditions would be defined through consultation with the rotenone formulation manufacturer.

Significance after Mitigation: Less than significant.

14.2.7 Human Health

Impact conclusions regarding human health and public safety from hazardous materials associated with Alternative A, are consistent with the Proposed Project for impacts HEH-6 to HEH-8, and HEH-10. Impact HEH-9 (inhalation risks from liquid rotenone formulation constituents) are downgraded to “less than significant” because the reduction in volume of liquid rotenone formulation applied to the streams (260 gallons) poses no inhalation risks whether Noxfish[®] or CFT Legumine[®] is used.

Effects of Fugitive Rotenone Dust on Human Health

Inhalation risks from fugitive rotenone dust from the use of the cube root are considered less than significant to human receptors (applicators), as PPE would be worn. Impacts from inhalation exposure to fugitive rotenone dust by the nearby human populations considered most sensitive in risk assessment represents a large source of uncertainty, and could be significant if not mitigated appropriately.

Impact HEH-14: Adverse human health impacts may be experienced by sectors of the public from the inhalation of rotenone dust volatilized into air after dilution in the treated waters. The impact is considered significant and adverse, but mitigable.

Mitigation HEH-14: Follow mitigation outlined in measure HEH-13 to manage potential risks of fugitive dust.

Significance after Mitigation: Less than significant.

14.2.8 Alternative B — 5,000 Acre-Feet (Plus Treatment)

14.2.8.1 Ecological Health

Because the principal routes of exposure to aquatic ecological receptors are the same as described for the Proposed Project and Alternative A—via bioconcentration from water, and because the concentrations of rotenone and rotenone formulation constituents would not change among treatments, significant impacts can be expected for aquatic invertebrates and amphibians and reptiles (Impacts HEH-2 and HEH-3). Modeled doses to terrestrial receptors of hazardous materials taken up through the food web model also do not differ from the Proposed Project and are, therefore, considered to be no adverse impact (impact HEH-4). However, it is worth noting that under Alternative B the surface area for exposure to contaminated water is one-third that of the Proposed Project, and while not modeled as such in Appendix J, it is possible that the drawdown required would reduce the total number of ecological receptors that would migrate to the waters edge to drink. Further, because drawdown would be lowest, the probability of ingestion of plant matter among herbivores along the waters edge would be greatly reduced as the forage would simply not be present due to the regular inundation regime of the regulated reservoir system.

The total volume of rotenone formulation to be used under Alternative B is the lowest, hence, the potential impact under a spill scenario would be the least for all the rotenone application alternatives. Further, uncertainties associated with the fate and transport of some rotenone formulation constituents would support this alternative as being the most protective to

ecological health for potential impacts from hazardous materials. Degradation via hydrolytic, photolytic and biological processes would result in the least likelihood of persistence of chemical contaminants under Alternative B. Despite these qualitative differences that may marginally reduce exposure, the conclusions on impact statements HEH-1 to HEH-5, as outlined under the Proposed Project, do not differ with Alternative B.

14.2.8.2 Human Health

Although inhalation risks are reduced accordingly because of the reduced amount of hazardous materials that would be used under this alternative, the evaluation of the Noxfish[®] formulation modeled air concentrations shows the HBSL for naphthalene is still exceeded for all human receptor populations modeled. This impact (HEH-9) is concluded to be adverse and significant, but mitigable by applying the measure outlined as mitigation measure HEH-9 under the Proposed Project (i.e., Noxfish[®] use would be balanced/combined with CFT Legumine[®] use that allows adequate rotenone concentrations in the water for the desired piscicide effect, but does not result in air concentrations for volatile solvent components above the HBSLs). Other impact and mitigation conclusions are consistent with the Proposed Project (i.e., impacts and mitigation measures HEH-6, 7, 8, 10).

14.2.9 Alternative C – 35,000 Acre-Feet (Plus Treatment)

14.2.9.1 Ecological Health

Impacts to aquatic and terrestrial ecological receptors from hazardous materials would be essentially consistent with the Proposed Project, as modeled doses through the exposure pathways modeled do not essentially change. Inhalation exposure of wildlife to some rotenone formulation constituents would be increased over that of the Proposed Project and Alternative B, but do not exceed inhalation toxicity thresholds in standard animal models that have been used as surrogates for inhalation risks to wildlife in the risk assessment (Appendix J).

Conclusions on ecological health impact statements HEH-1 to HEH-5, as addressed under the Proposed Project, do not differ under Alternative C. (Impacts to aquatic ecological receptors are considered significant but largely mitigable [with the exception of aquatic invertebrates], and impacts to terrestrial and avian wildlife are considered no impact).

14.2.9.2 Human Health

For Alternative C, general human health impact and mitigation conclusions for HEH-6, HEH-7 and HEH-8 are consistent with those identified under the Proposed Project. Notably, however, the evaluation of the Noxfish[®] formulation modeled air concentrations shows the air concentrations of naphthalene and other volatile and semi-volatile rotenone formulation constituents are increased under this alternative, (see Appendix J, Table J-41). (The CFT Legumine[®] concentrations do not exceed threshold values). The 1-hr maximum HBSL for naphthalene is exceeded for all human populations considered in the risk assessment out to at least 10,000 meters (the extent of the Screen3 dispersion model), and the 24-hr average is exceeded out to this same distance for the nearby resident and worker populations modeled

for risk assessment. The HBSL for trimethylbenzene is also marginally exceeded for the ‘nearby resident population’—both compounds to levels that exceed the HBSLs identified in Tables 14.2-4 and 14.2-5. Thus, the impact HEH-9 remains significant and potentially more adverse than under the Proposed Project. However, no difference in the mitigation, as identified for this impact under the Proposed Project is necessary.

Impacts from Odor

Under Alternative C, as projected in Table 14.2-5, the 1-hr maximum odor threshold for naphthalene is exceeded out to at least 1,000 meters. This is the first alternative for which an odor threshold is considered to have been exceeded. No other formulation constituents were exceeded.

Impact HEH-10a: Adverse impacts from odor are considered significant but mitigable for Alternative C.

Mitigation HEH-10a: Apply mitigation measure HEH-9 under the Proposed Project.

Significance After Mitigation: Less than significant.

14.2.10 Alternative D – 48,000 Acre-Feet (Plus Treatment)

14.2.10.1 Ecological Health

Impacts to aquatic and terrestrial ecological receptors from hazardous materials (i.e., impacts HEH-1 to HEH-5) would be consistent with the Proposed Project, and Alternatives A, B and C, as modeled rotenone and rotenone formulation exposure through aquatic bioconcentration, food web ingestion, and inhalation exposure risks do not change. Potential inhalation exposure to volatile and semivolatile constituents in the rotenone formulations increases under Alternative D but still does not exceed inhalation toxicity thresholds (where such thresholds have been identified). With the greater reservoir surface area to be treated under this alternative, the risk of a greater number of ecological receptors being exposed to rotenone formulation constituents would appear to be increased.

14.2.10.2 Human Health

General impacts to human receptor populations are consistent with those identified under the Proposed Project and Alternative A. The evaluation of the Noxfish[®] formulation modeled air concentrations shows naphthalene and other volatile and semi-volatile rotenone formulation constituents are the highest under this alternative. The HBSL for naphthalene is exceeded to the greatest extent for all human populations considered, and the HBSL for trimethylbenzene is also exceeded for the ‘nearby resident’ population—both compounds to levels that exceed those identified as HBSLs in Table 14.2-4 and Table 14.2-5.

Based on Screen3 air modeling, odor thresholds are also exceeded under Alternative D for naphthalene when using Noxfish[®], as discussed under Alternative C.

Impacts from odor are considered significant but mitigable, by applying the mitigation measure HEH-9. Significance after mitigation is less than significant.

14.2.11 Alternative E –Dewater Reservoir and Tributaries (No Chemical Treatment)

No significant or adverse impacts from hazardous materials would be expected under this alternative to either ecological or human health. Human health impacts from the illegal consumption of dead fish is possible, but unlikely, as the project description calls for the removal of dead fish from the project area and disposal at approved locations. Furthermore, with complete dewatering the ability to retrieve nearly all dead fish presents itself as an opportunity not possible under the Proposed Project or the other treatment alternatives.

14.2.12 Cumulative Impacts

This section addresses the use of additional hazardous materials and the potential for the generation of hazardous waste within the project area. The use of additional hazardous materials in the project area, particularly during the time of the proposed treatments, could create cumulative effects from the incremental impacts under consideration when combined with other activities, and is therefore a required component of impact analyses under NEPA and CEQA (Section 15355). The area of analysis includes the project area and the vicinity to areas within the Feather River watershed. The discussion below applies to the Proposed Project and treatment Alternatives A through D.

The use of additional hazardous materials in the project area not associated with the Proposed Project is likely from the general public's application of pesticides and herbicides for lawn and garden care and terrestrial pest eradication for home and public buildings and grounds managed by local municipalities and other county jurisdictions. No records have been identified to quantify the amount of use of hazardous materials by these entities, but no aquatic use pesticides are authorized for use to the general public, and no 24C FIFRA applications for special use of pesticide in the local jurisdictions that lie within or adjacent to the project area have been submitted. Thus, this additional use of herbicides and pesticides, to the extent that it occurs, does not result in a cumulatively considerable impact.

In addition to the use of hazardous materials by the general public and local municipal and county jurisdictions, the use of hazardous materials by Federal entities is known to occur within the project area. To this end, the Plumas National Forest is in the early stages of developing a proposal for eliminating noxious weed plant species at multiple sites across the forest, by a variety of methods – underburning, flaming, mechanical pulling, and treating with chemical herbicides. The project has been listed in the Forest Schedule of Proposed Projects, yet a proposal is not fully developed.

At the time of analysis for this EIR/EIS for pike eradication proposal, the most current information on the weed abatement project details approximately 200 known weed sites and potential treatments. This information has yet to be formed into an official proposed project, and is subject to change. All potential chemical treatments considered as reasonably foreseeable for the purposes of the cumulative effects analysis for the pike eradication project are summarized below in Table 14.2-6. Herbicides and weed species to be treated are summarized in Table 14.2-7. Weed sites outside of the Feather River watershed were not considered for this analysis.

Table 14.2-6. Summary of Reasonably Foreseeable Herbicide Treatments in the Feather River Watershed

Location of Weed Areas Proposed for Treatment	Acres
Lake Davis watershed above Grizzly Valley Dam	.0496
Middle Fork Feather, near Rocky Point	.0995
<i>Subtotal of treatment upstream of City of Portola</i>	<i>.1491</i>
Middle Fork at Jackson Creek	.5570
<i>Subtotal of treatment upstream of Cromberg</i>	<i>.7061</i>
Middle Fork Feather, in middle Canyon	.0682
Middle Fork Feather, in lower Canyon	.3596
Total above Lake Oroville from Mid Fork WS	1.1339
Total above Lake Oroville from North Fork WS	204.9145

Table 14.2-7. Proposed Treatment Details for Various Weed Species in the Preliminary Proposal for the Plumas NF Integrated Noxious Weed Control Program

Species	Chemical	Active Ingredient	Application Rate (lb AE/acre)*	Application Timing	Application Technique
black locust	Garlon 4	Triclopyr	4.000	fall	basalbark
broadleaved pepperweed	Telar	Chlorsulfuron	0.14 lb ai	summer/fall	foliar
Canada thistle	Transline	Clopyralid	0.375	summer	foliar
Dalmatian toadflax	Telar	Chlorsulfuron	0.375	summer/fall	foliar
Dyer's woad	Telar	Chlorsulfuron	0.14 lb ai	spring/summer	foliar
French broom	Garlon 4	Triclopyr	4.000	fall	foliar
hairy whitetop	Telar	Chlorsulfuron	0.14 lb ai	summer	foliar
hogbite					
Scotch broom	Garlon 4	Triclopyr	4.000	fall	basalbark /foliar
spotted knapweed	Transline	Clopyralid	0.375	summer	foliar
yellow starthistle	Transline	Clopyralid	0.375	summer	foliar

Note: All treatments will be made by hand with backpack sprayers.

* Maximum application rate as per label instructions.

One Spotted Knapweed site on the east shore of Lake Davis, at the Car Top Boat Launch north of Honker Cover is proposed for herbicide use. This site is 0.0496 acre in size. The proposed treatment for all weed sites is listed in Table 14.2-5. This is the only site proposed for chemical treatment in the Lake Davis/Big Grizzly Creek watershed, and hence the only site directly within the project area analyzed for direct effects from the use of hazardous materials. A yellow star thistle treatment of 0.0995 in the Middle Fork Feather River watershed immediately upstream of the City of Portola, but also within the Plumas National Forest (along Hwy 70, near Rocky Point) is also planned. These first two sites would aggregate into a total of 0.1491 acres of National Forest lands treated upstream of the City of Portola.

Outside of the project area and Plumas National Forest additional sites are planned, to include a broadleaved pepperweed and spotted knapweed treatment further downstream along the Middle Fork Feather River, near Jackson Creek, a total of 0.5570 acres. This treatment would bring the cumulative total of acres treated upstream of the communities of Cromberg and Sloat to 0.7061 acres.

Continuing downstream the Middle Fork Feather breaks into a long, steep and mostly inaccessible canyon. In the middle reaches of the canyon, in the vicinity of the South Branch, Hartman Bar and Millsap Bar, another 0.0682 acres would be treated for Scotch Broom and Hairy Whitetop. In the lower reaches of the canyon, where it enters into the stilled waters of Lake Oroville Reservoir, another 0.3596 acres of Black Locust and Barbed Goatgrass would be treated. These treatments would result in a total of 1.1339 acres of land treated upstream of Lake Oroville in the Middle Fork Feather River watershed.

National Forest System lands in the North Fork Feather River are also proposed for weed eradication treatments. Because they are not hydrologically linked to the Middle Fork Feather River until they reach Lake Oroville, the details of sites proposed for treatment are not summarized here. A total of 204.9145 acres of land would be treated for weeds in the North Fork Feather River watershed upstream of Lake Oroville. All of the weed species listed in Table 14.2-6 would be treated at various sites.

Finally, additional activities are also under consideration for the Integrated Noxious Weed Control proposal to be managed by the USFS. A second planning effort, the Middle Fork Whitetop Project, would chemically and mechanically treat Tall Whitetop at one site only, along the Middle Fork Feather River, 2 miles upstream of Big Grizzly Creek. Approximately 8 acres of land would be treated to different intensities depending on whitetop abundance with either Rodeo, Weedar 64 (2,4-D), or Telar. The official Proposed Project for this project has been distributed to the public for scoping comments and is available for further detail.

To summarize, none of the treatments planned by the USFS in the project area or in the other nearby areas summarized in Table 14.2-6 involve the use of aquatic pesticides or the direct application to water. Applications will be done with backpack sprayers ensuring minimal risk to aquatic life. Applications would be conducted by certified applicators following label instructions and application rates to ensure that non-target ecological and human receptor populations will not be affected. Further, additional use of herbicides by the general public is anticipated to be extremely low within the project area because of low population density, and because of the forest closure that would be implemented during the proposed treatment.

These factors permit a conclusion that the additional use of hazardous materials within the project area would not alter the conclusions for the Proposed Project or any of the alternatives. Thus, cumulative effects of the additional use of hazardous materials in the Project Area and are considered less than significant.

14.2.13 Environmental Impacts Summary

This section summarizes the relative impacts of the Proposed Project and project alternatives based specifically on the potential role of hazardous materials use under consideration in the project area. The following bullets summarize potential project impacts relevant to the CEQA environmental concern criteria applicable to the pike eradication project and discussed initially in Section 14.2.1.

- The **transportation and handling of rotenone** under all but the No Project and Alternative E (complete dewatering) poses a potentially significant risk of accidental spillage en route to the project area or at the project site. A spill of the formulated rotenone product could result in contamination of soil, water, and/or public and private property. Impacts due to accidental spill during transportation and handling could potentially be significant; however, these impacts are significantly reduced by the inclusion of a spill contingency plan, site safety plan, and site security plan. To further minimize the risks of spills, transportation routes to staging areas need to be clearly flagged. A forest closure would be in effect and enforced by Plumas National Forest and DFG personnel to prevent public access into the treatment areas. The safest access routes need be selected for transporting hazardous materials to the project site, and hazardous wastes away from the site. **The impact of spills under the Proposed Project and all alternatives that involve the use of rotenone is therefore concluded to be less than significant, and requires no further mitigation than that already proposed.**
- The Proposed Project and all alternatives except the No Action alternative involve the use of combustible materials that could, if improperly used, provide a combustion source for wildfire. As the project area lies within a National Forest, impacts from a wildfire could be significant. However, the transportation and application of the rotenone formulations proposed would be restricted to the surface of the reservoir, its tributaries, and developed roads and boat ramps. **Thus, the likelihood of the Proposed Project or project alternatives starting a wildfire, or affecting the ability of fire suppression efforts in the event of a wildfire in the project area, is considered less than significant.**

Table 14.2-8 provides a qualitative comparison among the alternatives for the thresholds of human and ecological health impact earlier defined in 14.2.1.1. The table also summarizes the relative difference in uncertainty associated with the significance determinations among the alternatives, based on the findings from the screening level risk assessment (Appendix J) that is the principal source of information for this section. Uncertainty is coded on a five point scale, where:

1. low level of uncertainty based on project action description and proposed hazardous materials use, additional information highly unlikely to alter significance determination;
2. moderately low level of uncertainty, additional information highly unlikely to alter significance determination unlikely to alter significance determination;

3. moderate level of uncertainty, additional information possible to alter significance determination;
4. moderately high level of uncertainty, additional information likely to lessen significance determination based on current modeling (if a significant impact was concluded in initial analysis) or increase significance (if no significant impact was concluded); and
5. high level of uncertainty, additional information highly likely to lessen significance determination based on current modeling (if a significant impact was concluded), or increase significance determination (if no significant impact was concluded).

Table 14.2-8 also provides a summary comparison of impacts of No Project, the Proposed Project, Alternatives A through D involving chemical treatment, and Alternative E with no chemical treatment. The tables address the environmental concerns of toxicity effects to ecological receptors first, followed by toxicity effects to humans, consistent with the summary tables in other resource sections.

Table 14.2-8. Comparison of Impacts of Alternatives from Hazardous Materials Use on Human and Ecological Health

Affected Resource and Area of Potential Impact	Alternative						
	No Project Compared to Existing Conditions	Proposed Project	A	B	C	D	E
Threshold of Significance Criteria							
1. Cause exceedance of federal or state agency surface or groundwater quality standard or water quality objective for hazardous materials or priority pollutants as recognized in the California Toxics Rule?	N [1]	N* [1]	N* [1]	N* [1]	N* [1]	N* [1]	N [1]
2. Result in an exceedance of a non-regulatory literature-based toxicity reference value for aquatic animal toxicity	N [1]	SM, A [1]	SM, A [1]	SM, A [1]	SM, A [1]	SM, A [1]	N [1]
3. Result in an exceedance of regulatory guidance or human health based screening level for air quality or inhalation risk	N [1]	SM, A [3]	SM, A [3]	SM, A [3]	SM, A [3]	SM, A [3]	N [1]
4. Result in an exceedance of a literature-based toxicity reference value for ingestion and/or inhalation uptake in relevant terrestrial or avian wildlife	N [1]	N [3]	N [3]	N [4]	N [2]	N [2]	N [1]
5. Result in an exceedance of a literature-based toxicity reference value for plant toxicity	N [1]	N [1]	N [1]	N [1]	N [1]	N [1]	N [1]

Table 14.2-8. Comparison of Impacts of Alternatives from Hazardous Materials Use on Human and Ecological Health

Affected Resource and Area of Potential Impact	Alternative						
	No Project Compared to Existing Conditions	Proposed Project	A	B	C	D	E
6. Expose the public, especially schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) to substantial pollutant concentrations, including those resulting in a cancer risk greater than or equal to one in a million, or a Hazard Index for non-cancerous risk of greater than or equal to 0.1.	N [1]	N [2]	N [2]	N [2]	N [2]	N [2]	N [1]
7. Cause a spill or leak that would contaminate the soil or waters to the extent of eradicating the existing vegetation, inhibiting revegetation, or migrating to other areas and affecting soil and/or aquatic ecosystems	N [1]	N [2]	N [2]	N [1]	N [3]	N [3]	N [1]
8. Create a potential health hazard or involve the use, production, or disposal of materials in a manner that would be expected to pose a hazard to a wildlife or fish population in the Project Area?	N [1]	SM, A [1]	SM, A [1]	SM, A [1]	SM, A [1]	SM, A [1]	N [1]
9. Create a potential health hazard or involve the use, production, or disposal of materials that pose a hazard to a special-status species population in the Project Area	N [1]	LS, A [2]	LS, A [2]	LS, A [1]	LS, A [3]	LS, A [3]	N [1]

Table 14.2-8. Comparison of Impacts of Alternatives from Hazardous Materials Use on Human and Ecological Health

Affected Resource and Area of Potential Impact	Alternative						
	No Project Compared to Existing Conditions	Proposed Project	A	B	C	D	E
10. Create a potential human health hazard through the generation of hazardous waste (e.g., dead fish)	N [1]	LS, A [1]	LS, A [1]	LS, A [1]	LS, A [1]	LS, A [1]	N [1]
11. Increases the likelihood of impact to fish, wildlife or human health in the event of an accidental spill of hazardous materials	N [1]	SM, A [1]	SM, A [1]	SM, A [1]	SM, A [1]	SM, A [1]	N [1]
Environmental Concerns							
HEH-1 Toxicity effects to non-target fish	N	LS, A	LS, A	LS, A	LS, A	LS, A	N
HEH-2 Toxicity effects to aquatic invertebrates	N	SU, A	SU, A	SU, A	SU, A	SU, A	N
HEH-3 Toxicity effects on amphibians and reptiles	N	SM, A	SM, A	SM, A	SM, A	SM, A	N
HEH-4 Toxicity effects on terrestrial and avian wildlife	N	N	N	N	N	N	N
HEH-5 Ecological effects from dead fish	N	LS, A	LS, A	LS, A	LS, A	LS, A	N
HEH-6 Toxicity effects to humans from surface water exposure	N	LS, A	LS, A	LS, A	LS, A	LS, A	N
HEH-7 Toxicity effects to humans from sediment exposure	N	LS, A	LS, A	LS, A	LS, A	LS, A	N
HEH-8 Toxicity effects to humans from drinking water exposure via wells	N	LS, A	LS, A	LS, A	LS, A	LS, A	N

Table 14.2-8. Comparison of Impacts of Alternatives from Hazardous Materials Use on Human and Ecological Health

Affected Resource and Area of Potential Impact	Alternative						
	No Project Compared to Existing Conditions	Proposed Project	A	B	C	D	E
HEH-9 Toxicity effects to humans from inhalation exposure	N	SM, A	LS, A	SM, A	SM, A	SM, A	N
HEH-10 Impacts to humans from odors	N	LS, A	LS, A	LS, A	SM, A	SM, A	N
HEH-11 Neutralization impacts on human and ecological health, Options 1 and 2	N	N	N	N	N	N	N
HEH-12 Neutralization impacts on human and ecological health, Options 3 and 4	N	LS, A	LS, A	LS, A	LS, A	LS, A	N
HEH-13 Effects of fugitive rotenone dust on wildlife	N	N	SM, A	N	N	N	N
HEH-14 Effects of fugitive rotenone dust on humans	N	N	SM, A	N	N	N	N

Key:

A = Adverse Impact (NEPA)

B = Beneficial Impact (NEPA)

LS = Less than Significant Impact (CEQA)

N = No Impact (CEQA, NEPA)

SM = Significant but Mitigable Impact (CEQA)

SU = Significant and Unavoidable Impact (CEQA)

Tbd = To Be Determined

[x] = uncertainty code on scale of 1 to 5 as described in text

*With the exception of human health standards for toluene and trichloroethylene, no rotenone formulation constituent criteria are identified in the CTR, and the estimated maximum environmental concentrations of both of these are below the surface water criteria identified in the CTR. A water quality objective for naphthalene of 170 ppb is identified by DHS for surface and groundwaters that could be used for drinking, and this guidance value would be initially exceeded in Lake Davis if Noxfish is used. However, this value is not recognized in the CTR, and Lake Davis would not be used for drinking water until rotenone formulation constituents are consistently undetectable in post-treatment monitoring.

14.2.13.1 Treatment Alternative That Presents Lowest Potential Risks from the Use of Hazardous Materials

With the exceptions of No Project and Alternative E, where no chemical use would occur, Alternative B has the highest likelihood to minimize hazardous materials impacts from the use of rotenone in Lake Davis for the following reasons:

- Lowest total use of hazardous materials yields lowest potential for human exposure to piscicide formulation constituents, and increases the margin of safety for ingestion, dermal and inhalation exposure to ecological receptors.
- Ingestion pathway for drinking contaminated water, although toxicologically insignificant, is likely to affect the lowest number of potential animals due to low drawdown conditions in the reservoir and smaller surface area.
- Dietary exposure by herbivores consuming inadvertently treated riparian and littoral vegetation would likely be reduced because the elevation of the reservoir would be substantially lower than the elevation at which littoral and/or riparian forage would be found. Thus, it would seem very unlikely that herbivores could consume treated vegetation along the reservoir shoreline under this alternative.
- Dietary exposure of dead fish by terrestrial wildlife would likely be curtailed to the greatest degree under this treatment alternative (i.e., of the rotenone treatment alternatives) because the active removal of dead fish would be more efficient due to the smaller surface area proposed under this alternative. Thus, although dietary risks were found to be less than significant for wildlife, this alternative improves the margin of safety for dietary consumption associated with uncertainty in the risk modeling.
- Under the worst case scenario of an accidental spill, the worst impact possible from the spill would likely be less significant than the worst impact possible from a spill with the other treatment alternatives where more hazardous materials are required.

14.2.14 Monitoring

Surface and groundwater quality in Lake Davis and Big Grizzly Creek would be monitored under a program developed by the DFG in consultation with, and as required by, the California Department of Health Services, the Central Valley Regional Water Quality Control Board and in consultation with Plumas County Environmental Health. These programs would be implemented as further clarified in Sections 3.1.2.13, 3.2.2.12, 4.1.1.3, and 5.2.11. Some or all portions of the monitoring program may developed as part of permitting requirements under the National Pollution Discharge Elimination System permitting program (administered by the Central Valley Regional Water Quality Control Board) and/or the California Public Health and Safety Code Section 116571 (administered by the California Department of Health Services).

Air quality monitoring would be conducted in accordance with specifications outlined in Section 5.3. In cooperation with the NSAQMD, details of the air quality monitoring program would be formalized during the design phase of the project, including frequency and location of monitoring, as well as the appropriate constituents.